



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Science
Department of Chemistry

Name of Program: M.Sc. (Chemistry) (CBCS) (2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCH301	PG	Spectroscopic methods	3	0	0	3	60	20	20	00	00

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

1. To give basic knowledge of concept of Spectroscopic methods.
2. To develop the understanding of structure determination.
3. Enable students to apply the concepts of Laws of Photochemistry.
4. The purpose of the course is to make the students to understand the concepts and practical applications of Spectroscopy and Electrochemistry.

COURSE OUTCOMES:

After completion of this course the students are expected to demonstrate the following skills, knowledge, and attitudes. Student will be able to understand:

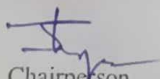
1. Theoretical understanding of concept of Spectroscopic methods
2. Became aware of the different types of Spectroscopic techniques and structure determination.
3. Students will be able to understand Electrochemical techniques.
4. The students will be able to understand the practical applications of Spectroscopy and Electrochemistry.


SYLLABUS:

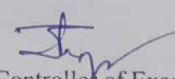
UNIT I

Nuclear Magnetic Resonance: The contact and pseudo contact shifts, factors affecting nuclear relaxation, some applications including biological systems, an overview of NMR of metal nuclides. Chemical shift, spin-spin interaction, shielding mechanism, complex spin-spin interaction, virtual coupling stereochemistry, hindered rotation, variation of coupling constant with dihedral angle, nuclear magnetic double resonance, simplification of complex spectra, shift reagent, spin tickling, nuclear overhauser effect (NOE), resonance of other nuclei.

¹³C NMR: Chemical shift, ¹³C coupling constants, two-dimensional NMR spectroscopy, NOISY, DEPT, INEPT.


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UNIT II

Emission Spectroscopy: Elementary idea of emission spectroscopy, introduction, elementary theory, instrumentation, types of flames, interferences, factors affecting flame photometry, applications to qualitative and quantitative analysis, limitations.

Fluorescence and Phosphorescence: Spectrophotometry, Theory of fluorescence and phosphorescence, quantum yield, Factors affecting fluorescence and phosphorescence, Relation between concentration and intensity, Instrumentation, Applications, an elementary idea of Chemiluminescence.

UNIT III

Electrochemical techniques: CV, polarography, coulometry, amperometry. Thermal Methods: TGA, DSC and DTA

Other Spectro-analytical techniques:

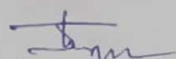
(A) Introduction, general principle, instruments for nephelometry and turbidimetry, applications of nephelometry and turbidimetry to analytical chemistry. (B) Dispersion Refractometry and Flame photometry (C) Polarometry, circular dichroism (CD) and optical rotatory dispersion (ORD).


UNIT IV

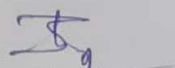
Mass Spectrometry : Theory and principles of mass spectrometry, Instrumentation, low and high resolution mass spectra, Ionization techniques – Electron Impact (EI) ionization, Chemical Ionization (CI), Field Desorption (FD), Fast Ion Bombardment (FAB), Electron spray Ionization (ESI) and Matrix Assisted Laser Desorption/Ionization (MALDI),

Mass spectrometry – fragmentation patterns of simple organic molecules, solving structure elucidation problems using mass spectrometry

Raman spectroscopy: Introduction, principle, instrumentation, and applications.


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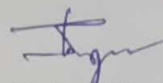
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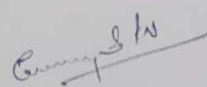
UNIT V

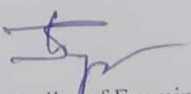
Infra-red spectroscopy – Basic concepts, experimental methods, functional group analysis and identification using IR spectroscopy, structural effects on vibrational frequency.
UV-Vis spectroscopy, electronic transitions in organic molecules, selection rules, application of Beer Lambert law, qualitative and quantitative analysis by UV-Vis spectroscopy.
X-ray crystallography: Bragg's law, different X-ray diffraction methods including rotating crystal technique, X-ray powder technique, applications of X-ray diffraction.

Text Books:

1. Spectroscopy, D. L.Pavia, G. M.Lampman, G. S. Kriz, J. R. Vyvyan, Cengage Learning (Indian Edition), 2007.
2. Organic Spectroscopy, William Kemp, 3rd Edition, 1991, Macmillan (Indian Edition).
3. NMR Spectroscopy, H. Gnther, second edition, John Wiley and sons, 1998.


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MSCH302	PG	Organometallic Chemistry	3	0	0	3	60	20	20	00	00

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COURSE OBJECTIVES:

1. To give basic knowledge of concept of Organometallic Chemistry.
2. To develop the understanding of Application of Organometallics in Industry.
3. Enable students to apply the concepts of Metal carbonyl complexes.
4. To develop & learn practical approach of conducting experiments and analyze experimental data of Organometallic Chemistry.

COURSE OUTCOMES:

After completion of this course the students are expected to demonstrate the following skills, knowledge, and attitudes. Student will be able to understand:

1. Theoretical understanding of concept of Organometallic Chemistry
2. Became aware of the Application of Organometallics in Industry.
3. Students will be able to apply the concepts of Metal carbonyl complexes.
4. Laboratory work is intended for students to learn conducting experiments, and analyze experimental data of Organometallic Chemistry.

SYLLABUS:

UNIT I

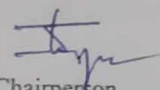
Definition, classifications, and bonding in organometallic compounds. Isolobal analogies. Structural methods of Organometallics. Preparative methods. Spectroscopic techniques in Organometallic chemistry. Electronic and magnetic properties of Organometallic compounds.

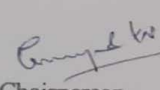
UNIT II

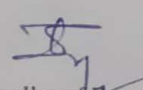
Stoichiometric and catalytic reactions. Fundamental processes in reactions of organo-transition metal complexes. Applications of transition metal complexes to catalysis, organometallics directed towards organic synthesis.

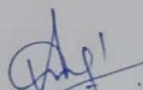
UNIT III

Bio-organometallics, Organometallics in environmental chemistry. Metal clusters and models for heterogeneous catalysis. Application of Organometallics in Industry. Metallocenes.


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MSCH302	PG	Organometallic Chemistry	3	0	0	3	60	20	20	00	00

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UNIT IV

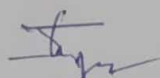
Metal carbonyl complexes, Metal carbonyls –Part II, Ligand substitution reactions, Substitutes for carbonyl ligands, Carbene complexes, Carbene complexes continued Non-Carbon Ancillary ligands Non-Carbon Ancillary ligands continued, Metal alkyl complexes, Ligand Insertion Reactions

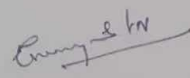
UNIT V

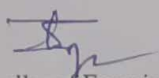
Metal alkene complexes, Metal dihydrogen and hydrides, Migratory Insertion reaction with alkynes. Oxidative addition & complex mechanism Reductive elimination Reductive Elimination mechanism Oxidative coupling with C-C bond formation, Metathesis reactions.

Text Books:

1. Organometallics: A Concise Introduction Authors: Christoph Elschenbroich Year:2006.
2. Fundamentals of Organometallic Catalysis Author: Dirk Steinborn Year:2012 Publisher: Wiley-VCH ISBN:978-3-527-32717-1.
3. Basic Organometallic Chemistry: Concepts, Syntheses and Application Authors: BD Gupta & Anil J Elias Year:2013 Publisher: Universities Press ISBN:978-81-7371-709-3.
4. Fundamentals of Organometallic Catalysis Author: Dirk Steinborn Year:2012 Publisher: Wiley-VCH ISBN:978-3-527-32717-1.
5. Organometallic Chemistry and Catalysis Author: Didier Astruc Year: 2007 Publisher: Springer ISBN:978-3-540-46129-6.


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MSCH303	PG	Chemistry of Natural Products	3	0	0	3	60	20	20	00	00

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

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COURSE OBJECTIVES:

1. To give basic knowledge of concept of the field of natural products chemistry.
2. To develop the understanding to Identify natural products and their probable biosynthetic pathways.
3. Enable students to Enhance their understanding of biological and biochemical sciences.
4. The purpose of the course is to make the students to understand the concepts and practical applications of Chemistry of Natural Products.

COURSE OUTCOMES:

After completion of this course the students are expected to demonstrate the following skills, knowledge, and attitudes. Student will be able to understand:


1. Theoretical understanding of concept of the field of natural products chemistry
2. Became aware of the Identification of natural products and their probable biosynthetic pathways .
3. Students will be able to Enhance their understanding of biological and biochemical sciences.
4. The students will be able to understand the practical applications of Chemistry of Natural Products.

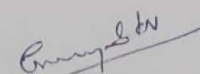
SYLLABUS:

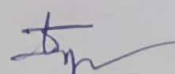
UNIT I: Alkaloids

Introduction and functions of alkaloids. General methods of structural elucidation, synthesis, and biological properties of coniine, piperine, nicotine and papaverine

Introduction, Importance, Synthesis and structural elucidation of Morphine, Quinine, Reserpine


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MSCH303	PG	Chemistry of Natural Products	3	0	0	3	60	20	20	00	00

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UNIT II: Terpenoids and Carotenoids :

Terpenoids: Introduction, Isoprene rule General methods of determining structure and synthesis of citral, menthol, Geraniol and camphor.

Carotenoids

Introduction, geometrical isomerism Structure determination and synthesis of β carotene and vitamin-A

UNIT III: Anthocyanines and flavones

Anthocyanines

Introduction to anthocyanines. Structure and general methods of synthesis of anthocyanines. Cyanidine chloride: structure determination and importance.

Flavones

Structure and determination of flavones and flavonoids. Quercetin: Structure determination and importance.

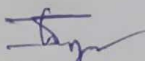
UNIT IV: Purines and Steroids

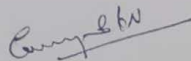
Purines


Introduction, biological importance Synthesis and structural elucidation of Uric acid, Xanthine, Caffeine and Theophylline.

Steroids

Introduction, stereochemistry and nomenclature. Structural determination and synthesis of cholesterol.


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MSCH303	PG	Chemistry of Natural Products	3	0	0	3	60	20	20	00	00

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UNIT V:

Natural Dye and synthetic Dye: Occurrence, colour and constitution Structural determination and synthesis of indigoitin and alizarin.

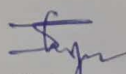
Occurrence, colour and constitution Structural determination and synthesis of some important synthetic dyes.

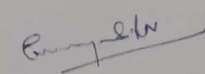
Text Books:

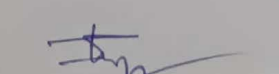
1. O. P. Agarwal, Chemistry of Natural Products, Vol-1, Goel Publishing House, 1997.
2. Gurdeep Chatwal and Anand, Chemistry of Natural Products, Himalayan Publishing Co, 2001

Reference Books:

1. I. L. Finar, Organic Chemistry, Vol-2, 5th edition, Pearson education, London, 1975.


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MSCH304 (A)	PG	Electrochemistry and Molecular reaction dynamics	3	0	0	3	60	20	20	00	00

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COURSE OBJECTIVES:

1. To give basic knowledge of concept of Electrochemistry.
2. To develop the understanding of Molecular reaction dynamics.
3. Enable students to apply the concepts of Ion-solvent interactions.
4. The purpose of the course is to make the students to understand the concepts and practical applications of Electrochemistry and Molecular reaction dynamics.

COURSE OUTCOMES:

After completion of this course the students are expected to demonstrate the following skills, knowledge, and attitudes. Student will be able to understand:

1. Theoretical understanding of concept of Electrochemistry.
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3. Students will be able to apply the concepts of Ion-solvent interactions.
4. The students will be able to understand the practical applications of Electrochemistry and Molecular reaction dynamics

Syllabus:

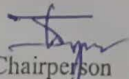
Unit I :

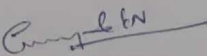
Ion-solvent interactions: Non structural treatment, Born-model, modification of Born model, thermodynamics of Ion-solvent interaction.

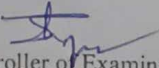
Structural treatment: Structure of water, structure of water near an ion. Ion-dipole model of ion solvent interaction, ion-quadrupole model of ion-solvent interaction. Solvation number: Static and dynamic picture of ion-solvent molecules interaction.

Unit II:

Surface excess, electrocapillary phenomena, Lippmann theory, electrochemical kinetics, Butler-Volmer treatment, rate of electrode processes (stoichiometric numbers). Different electrochemical reactions; rapid Electrochemical reactions, organic electrode processes, Bio-chemical reactions, Electrocatalysis.


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MSCH304 (A)	PG	Electrochemistry and Molecular reaction dynamics	3	0	0	3	60	20	20	00	00

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UNIT III

Introduction, importance of entropy in irreversible thermodynamics, postulates of irreversible thermodynamics, Flux and forces, Caretheodory principle, general conservation equation for matter and Energy at the local equilibrium, Curie-Prigogine principle, Diffusion in binary solution: Diffusion in free solution under concentration, pressure and electrostatic potential gradient, sedimentation and centrifugation. Electrochemical systems: Chemical reaction, Peltier and Seebeck effects. Uses of irreversible thermodynamics in membrane and soil science.

UNIT IV

Differential and integrated rate laws, reaction mechanism, temperature dependence, Collision theory and cross-section, thermal averages, threshold and activation energy, transition-state theory. Intermolecular forces, potential energy surfaces, centrifugal barrier, molecular trajectories, Polanyi rules, scattering, transition-state spectroscopy.

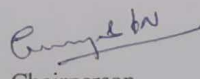
UNIT V

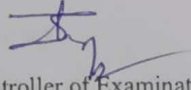
Internal vibrational redistribution, intermolecular energy transfer, Landau-Teller model, Landau-Zener curve crossing, Cage effect, diffusion control, solvation energy, Marcus theory of electron transfer, Kramer's theory.


Text Books:

1. Modern Electrochemistry Vol. I & II, J.O.M Bockris & A. K. N. Reddy, Plenum Press (1998)


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							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCH304 (B)	PG	Applied Dairy Chemistry and Technology	3	0	0	3	60	20	20	00	00

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

1. To give basic knowledge of concept of Applied Dairy Chemistry.
2. To develop the understanding of dairy products.
3. Enable students to apply the concepts of Dairy Chemistry and Technology.
4. To develop & learn practical approach of conducting experiments and analyze experimental data of Applied Dairy Chemistry and Technology.

COURSE OUTCOMES:

After completion of this course the students are expected to demonstrate the following skills, knowledge, and attitudes. Student will be able to understand:

1. Theoretical understanding of concept of Applied Dairy Chemistry
2. Became aware of the dairy products.
3. Students will be able to apply the concepts of Dairy Chemistry and Technology.
4. Laboratory work is intended for students to learn conducting experiments, and analyze experimental data of Applied Dairy Chemistry and Technology.

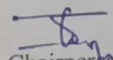
SYLLABUS:

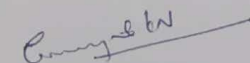
UNIT I

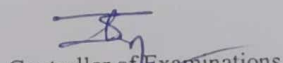
Use of bio-protective factors for preservation of raw milk: effects on physicochemical, microbial, and nutritional properties of milk and milk products, present status of preservation of raw milk by chemical preservatives; thermal processing for preservation.

UNIT II

Methods of determining lethality of thermal processing, UHT processed milk products, their properties and prospects, types of UHT plants, aseptic fillers, heat stability and deposit formation aspects, effect on milk quality; techno- economic considerations; retort processing.


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Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Department of Chemistry

Name of Program: M.Sc. (Chemistry) (CBCS) (2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCH304 (B)	PG	Applied Dairy Chemistry and Technology	3	0	0	3	60	20	20	00	00

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

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UNIT III

Principles and equipment for bactofugation and Bactotherm processes, Micro fluidization of milk: Principle, equipment, effects and applications, Homogenization, and their applications in dairy industry.

UNIT IV

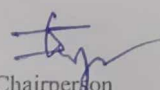
Dehydration: advances in drying of milk and milk products; freeze concentration, freeze dehydration: physicochemical changes during freeze drying and industrial developments.

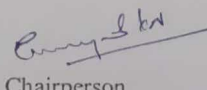
UNIT V

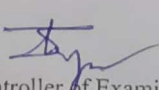
Water activity; sorption behavior of foods, energy of binding water, control of water activity of different milk products in relation to their chemical; microbiological and textural properties; hurdle technology and its application in development of shelf-stable and intermediate-moisture foods, Use of carbonation in extending the shelf life of dairy products.

Text Books:

1. Burton H. 1998. Ultra-high Temperature Processing of Milk and Milk Products. Elsevier. Fellow P. 1988.
2. Food Processing Technology. Elliss Horwood Ltd. Gould GW. 1995.
3. New Methods of Food Preservation. Blackie. IDF Bulletin 1981. New Monograph on UHT Milk. Document No. 133, Intern. Dairy Fed., Brussels. Smit G. 2003.
1. Dairy Processing - Improving Quality. CRC-Woodhead Publ. Troller JA & Christian HB. 1978.
2. Water Activity and Food, Food Science and Technology. A Series of Monograph Academic Press, London. Walstra P, Geurts TJ, Noomen A, Jellema A & Van Boekel MAJS. 1999.
3. Dairy Technology - Principles of Milk Properties and Processes. Marcel Dekker.


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Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Science
Department of Chemistry
Name of Program: M.Sc. (Chemistry) (CBCS) (2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCH304 (C)	PG	Pharmaceuticals Chemistry	3	0	0	3	60	20	20	00	00

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

1. To give basic knowledge of concepts of pharmaceutical industry.
2. To develop the understanding of fundamentals of Drugs discovery.
3. Enable students to apply the concepts of Instrumental analysis.
4. The purpose of the course is to make the students to understand the concepts and practical applications of manufacture of the bulk drugs.

COURSE OUTCOMES:

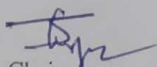
After completion of this course the students are expected to demonstrate the following skills, knowledge, and attitudes. Student will be able to understand:

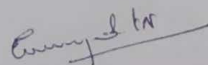
1. Theoretical understanding of concept of pharmaceutical industry.
2. The graduates will become familiar with fundamentals of Drugs discovery.
3. Students will be able to apply the concepts of Instrumental analysis.
4. The students will be able to understand the practical applications of manufacture of the bulk drugs.


SYLLABUS:

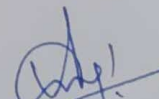
Unit- I

Historical background and development of pharmaceutical industry in India, Introduction to pharmacopoeias. Types of formulations and routes of administration. Aseptic conditions, need for sterilization, Method of sterilization, Introduction to types of hazards with special reference to chemical hazards and fire hazards, Material safety data sheet (MSDS), hazard labels of chemicals and personal protection equipment (PPE).


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Shri Vaishnav Institute of Science
Department of Chemistry
Name of Program: M.Sc. (Chemistry) (CBCS) (2021-2023)

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							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MSCH304 (C)	PG	Pharmaceuticals Chemistry	3	0	0	3	60	20	20	00	00

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Unit-II

Various types of pharmaceutical excipients – their chemistry, process of manufacture and quality specifications – Glidants, lubricants, diluents, preservatives, antioxidants, emulsifying agents, coating agents, binders, coloring agents, flavoring agents, gelatin and other additives, sorbitol, mannitol, viscosity builders.


Unit-III

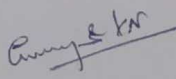
Evaluation of crude drugs – moisture contents, extractive value, volatile oil content, foreign organic matter. Quantitative microscopic exercises including starch, crude fiber content. Various isolation procedures for active ingredients.

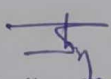
Pharmaceutical Quality Control – sterility testing, pyrogenic testing, glass testing, bulk density of powders.

Unit-IV

Introduction, principle, instrumentation, and application of: UV-Visible spectroscopy, IR Spectroscopy, Mass spectrometry, Chromatography, scanning electron microscopy (SEM), transmission electron, microscopy (TEM), Electron microscopy, NMR Spectroscopy, TGA, DTA and DSC.


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Shri Vaishnav Institute of Science
Department of Chemistry

Name of Program: M.Sc. (Chemistry) (CBCS) (2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
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MSCH304 (C)	PG	Pharmaceuticals Chemistry	3	0	0	3	60	20	20	00	00

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

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Unit-V

Raw materials, process of manufacture of the following bulk drugs –

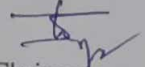
Sulpha drugs, antimicrobial drugs, Analgesic-anti-inflammatory, Steroidal hormones, Antibiotics drugs, Antimalarial drugs, Anticancerous drugs, AntiAIDS vaccines

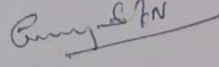
Text Books:

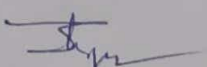
1. "Textbook of Pharmaceutical Chemistry-I (Inorganic)" by Mohammed Ali
2. "Pharmaceutical Chemistry-1" by Dr Kasture Dr Wadodkar
3. "Practical Pharmaceutical Chemistry: v. 2" by A H Beckett
4. "Medicinal and Pharmaceutical Chemistry" by V K Kapoor & Harkishan Singh
5. "Concise Organic Pharmaceutical Chemistry" by Deshmukh and Kuchekar

Reference Books:

1. Pharmacopoeia of India, Ministry of Health, Govt. of India.
2. Skoog D.A., Holler F.J., Crouch S. R., Instrumental Analysis, Indian Edition, Brooks/Cole, Boston.
3. Willard H.H., Merrit L.L., Dean J.A., Settle P.A., Instrumental Methods of analysis, CBS Publishers and Distributors New Delhi.
4. Becket A.H. and Stenlake J.B., Practical Pharmaceutical Chemistry Vol. I and II, The Athlone Press of the University of London.
5. Pavia D.L., Lampman G.M. and Kriz G.S., Introduction to Spectroscopy, Harcourt College Publishers, Philadelphia.
6. Chatten L.G., A Text Book of Pharmaceutical Chemistry, Vol. I and II, Marcel Dekker, New York.


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