



॥ तमसो मा ज्योतिर्गमय ॥

VISION

To provide equal opportunities for value based global education for creating an Enlightened Society

MISSION

To establish and facilitate educational institutions in the region for providing affordable value based global education to all who aspire to study and to create opportunities to educators, social workers and philanthropists to serve society



SARVAJANIK
UNIVERSITY

INCLUSIVE | INTEGRATED | INNOVATIVE

creating an enlightened society...

UNIVERSITY OFFICE

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CURRICULUM FOR

**“BACHELOR OF
SCIENCE (HONS)” /
“BACHELOR OF
SCIENCE (HONS
WITH RESEARCH)”**

B.Sc. (Hons) (Chemistry)

**B.Sc. (Hons with Research)
(Chemistry)**

SEM – 7

SEM – 8

w.e.f. Academic Year 2026-27

Constituent Institute:

**Shree Ramkrishna Institute of
Computer Education and Applied
Sciences (SRKI)**



Course Curriculum

BACHELOR OF SCIENCE (Hons) / BACHELOR OF SCIENCE (Hons with Research) (CHEMISTRY) Sem-7 and 8

The Course Curriculum of Bachelor of Science (Chemistry) was proposed and drafted by **Academic and Curriculum Committee of Chemistry** under the Faculty of Science in the meeting held on **02-07-2026** and recommended to '**BOARD OF STUDIES**' for approval.

Dr. Chaulami Desai
Chairman, Academic
& Curriculum Committee
Science

Place of the meeting
Sarvajani University Office


Sign

The proposed Course Curriculum was approved by **Board of Studies; Science** under the Faculty of Science in the meeting held on **21-08-2026** and was recommended to the '**FACULTY**' for approval.

Dr. Jay Bergi
Chairman,
Board of Studies- Science

Place of the meeting
Sarvajani University Office


Sign

The Course Curriculum approved by the **Faculty of Science** in the meeting held on **21-08-2026** and was recommended to '**ACADEMIC COUNCIL**' for approval.

Dr. Jay Bergi
Chairman & Dean,
Faculty of Science

Place of the meeting
Sarvajani University Office


Sign

The Course Curriculum approved by the '**Academic Council of Sarvajani University**' in the meeting held on **16-09-2026**.

Mr. Ashish Desai
Member Secretary,
Academic Council
& I/c. Registrar,
Sarvajani University

Place of the meeting
Sarvajani University Office


Sign

- The approved curriculum of Bachelor of Science (Hons) / Bachelor of Science (Hons with Research) (Chemistry) Sem-7 and 8 is with effect from the Academic year 2026-27



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Sem-VII and VIII



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Faculty of Science
B. Sc. (Honours) Chemistry
B.Sc. (Honours with Research)
Chemistry

DETAILED CURRICULUM

(W.E.F. 2026-27)



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Credit Framework for Four Years Undergraduate Program (As per KCG SOP)
Faculty of Science, Sarvajani University

Semester	Major						Minor		Skill Enhancement		Ability Enhancement		Multidiscipline		Value Added		Total Credits
	Major No. of Papers	Theory		Lab		Total Major Credits	Credits		No. of Papers	Credits	Credits		No. of Papers	Credits	No. of Papers	Credits	
		Theory Hours	Theory Credits	Lab Hrs	Lab Credits		No. of Papers	Credits			No. of Papers	Credits					
1	2	3+3	3+3	2+2	1+1	8	1	4	1	2	1	2	1	4	1	2	22
2	2	3+3	3+3	2+2	1+1	8	1	4	1	2	1	2	1	4	1	2	22
3	3	3+3+3	3+3+3	2+2+2	1+1+1	12	0	0	1	2	1	2	1	4	1	2	22
4	3	3+3+3	3+3+3	2+2+2	1+1+1	12	1	4	1	2	1	2	1	4	1	2	22
5	3	3+3+3	3+3+3	2+2+2	1+1+1	12	2	8	1	2							22
6	3	3+3+3	3+3+3	2+2+2	1+1+1	12	1	4	Internship	4	1	2					22
Total after 3y	16					64	6	24	5+	10+4	5	10	3	12	4	8	132
7 (Honors)	4	3+3+3+3	3+3+3+3	2+2+2+2	1+1+1+1	16	1	4	1	2							22
8 (Honors)	4	3+3+3+3	3+3+3+3	2+2+2+2	1+1+1+1	16	1	4	1	2							22
7 (Research)	3	3+3+3	3+3+3	2+2+2	1+1+1	12	1	4	RP	6							22
8 (Research)	3	3+3+3	3+3+3	2+2+2	1+1+1	12	1	4	RP	6							22
Total after 4y	24/22					96/88	8	32	7+	18/26	5	10	3	12	4	8	176



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B.Sc (Honours) (Chemistry) / B.Sc (Honours with Research) (Chemistry)

Sem-VII and VIII

Teaching Scheme for B.Sc. (Hons) / B.Sc. (Hons with Research) Semester – I to VIII						
Semester	Course Category	Credits	Theory (Hrs/Week)	Theory (Total)	Laboratory (Hrs/Week)	Laboratory (Total)
B.Sc. (Hons) / B.Sc. (Hons with Research)						
I	Major	4	3	45	2	30
	Major	4	3	45	2	30
	Minor	4	3	45	2	30
	Skill Enhancement Courses	2	2	30	0	0
	Ability Enhancement Courses	2	2	30	0	0
	Value Added Courses	2	2	30	0	0
	Multidisciplinary	4	4	60	0	0
	Total	22	19	285	6	90
II	Major	4	3	45	2	30
	Major	4	3	45	2	30
	Minor	4	3	45	2	30
	Skill Enhancement Courses	2	2	30	0	0
	Ability Enhancement Courses	2	2	30	0	0
	Value Added Courses	2	2	30	0	0
	Multidisciplinary	4	4	60	0	0
	Total	22	19	285	6	90
III	Major	4	3	45	2	30
	Major	4	3	45	2	30
	Major	4	3	45	2	30
	Skill Enhancement Courses	2	2	30	0	0
	Ability Enhancement Courses	2	2	30	0	0
	Value Added Courses	2	2	30	0	0
	Multidisciplinary	4	4	60	0	0
	Total	22	19	285	6	90
IV	Major	4	3	45	2	30
	Major	4	3	45	2	30
	Major	4	3	45	2	30
	Minor	4	3	45	2	30
	Skill Enhancement Courses	2	2	30	0	0
	Ability Enhancement Courses	2	2	30	0	0
	Value Added Courses	2	2	30	0	0
	Total	22	18	270	8	120



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Teaching Scheme for B.Sc. (Hons) Semester – I to VIII						
Semester	Course Category	Credits	Theory (Hrs/Week)	Theory (Total)	Laboratory (Hrs/Week)	Laboratory (Total)
B.Sc. (Hons) / B.Sc. (Hons with Research)						
V	Major	4	3	45	2	30
	Major	4	3	45	2	30
	Major	4	3	45	2	30
	Minor	4	3	45	2	30
	Minor	4	3	45	2	30
	Skill Enhancement Courses	2	2	30	0	0
	Total	22	17	255	10	150
VI	Major	4	3	45	2	30
	Major	4	3	45	2	30
	Major	4	3	45	2	30
	Minor	4	3	45	2	30
	Skill Enhancement Courses	4	-	-	12	180
	Ability Enhancement Courses	2	2	30	0	0
	Total	22	14	210	20	300
VII	Major	4	3	45	2	30
	Major	4	3	45	2	30
	Major	4	3	45	2	30
	Minor	4	3	45	2	30
	Skill Enhancement Courses	2	2	30	0	0
	Total	18	14	210	8	120
VIII	Major	4	3	45	2	30
	Major	4	3	45	2	30
	Major	4	3	45	2	30
	Minor	4	3	45	2	30
	Skill Enhancement Courses	2	2	30	0	0
	Total	18	14	210	8	120
Semester	Course Category	Credits	Theory (Hrs/Week)	Theory (Total)	Laboratory (Hrs/Week)	Laboratory (Total)
B.Sc. (Hons with Research)						
VII	Research Project	6	2	30	8	120
VIII	Research Project	6	2	30	8	120



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Sem-VII and VIII

Evaluation Scheme for B.Sc. (Hons) Semester I to VIII							
Semester	Course Category	Continuous and Comprehensive Evaluation (CCE)			Total CCE	Semester End Examination (SEE)	Grand Total
		CCE	Assignment	Attendance			
B.Sc. (Hons) / B.Sc. (Hons with Research)							
I	Major	30	10	10	50	50	100
	Major	30	10	10	50	50	100
	Minor	30	10	10	50	50	100
	Skill Enhancement Courses	15	5	5	25	25	50
	Ability Enhancement Courses	15	5	5	25	25	50
	Value Added Courses	15	5	5	25	25	50
	Multidisciplinary	30	10	10	50	50	100
II	Major	30	10	10	50	50	100
	Major	30	10	10	50	50	100
	Minor	30	10	10	50	50	100
	Skill Enhancement Courses	15	5	5	25	25	50
	Ability Enhancement Courses	15	5	5	25	25	50
	Value Added Courses	15	5	5	25	25	50
III	Major	30	10	10	50	50	100
	Major	30	10	10	50	50	100
	Major	30	10	10	50	50	100
	Skill Enhancement Courses	15	5	5	25	25	50
	Ability Enhancement Courses	15	5	5	25	25	50
	Value Added Courses	15	5	5	25	25	50
	Multidisciplinary	30	10	10	50	50	100
IV	Major	30	10	10	50	50	100
	Major	30	10	10	50	50	100
	Major	30	10	10	50	50	100
	Minor	30	10	10	50	50	100
	Skill Enhancement Courses	15	5	5	25	25	50
	Ability Enhancement Courses	15	5	5	25	25	50
	Value Added Courses	15	5	5	25	25	50



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Evaluation Scheme for B.Sc. (Hons) Semester I to VIII							
Semester	Course Category	Continuous and Comprehensive Evaluation (CCE)			Total CCE	Semester End Examination (SEE)	Grand Total
		CCE	Assignment	Attendance			
B.Sc. (Hons) / B.Sc. (Hons with Research)							
V	Major	30	10	10	50	50	100
	Major	30	10	10	50	50	100
	Major	30	10	10	50	50	100
	Minor	30	10	10	50	50	100
	Minor	30	10	10	50	50	100
	Skill Enhancement Courses	15	5	5	25	25	50
VI	Major	30	10	10	50	50	100
	Major	30	10	10	50	50	100
	Major	30	10	10	50	50	100
	Minor	30	10	10	50	50	100
	Skill Enhancement Courses	-	-	-	50	50	100
	Ability Enhancement Courses	15	5	5	25	25	50
VII	Major	30	10	10	50	50	100
	Major	30	10	10	50	50	100
	Major	30	10	10	50	50	100
	Minor	30	10	10	50	50	100
	Skill Enhancement Courses	15	5	5	25	25	50
VIII	Major	30	10	10	50	50	100
	Major	30	10	10	50	50	100
	Major	30	10	10	50	50	100
	Minor	30	10	10	50	50	100
	Skill Enhancement Courses	15	5	5	25	25	50
Semester	Course Category	Continuous and Comprehensive Evaluation (CCE)			Total CCE	Semester End Examination (SEE)	Grand Total
		CCE	Assignment	Attendance			
B.Sc. (Hons with Research)							
VII	Research Project	30	10	10	50	50	100
VIII	Research Project	30	10	10	50	50	100



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SEM - 7

DETAILED CURRICULUM
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Sem-VII and VIII

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. (Hons.) / (Hons. with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VII		Effective From	June, 2026		
Course Code	BSCH11701	Course Name	Major: Chemistry of Drugs and Dyes (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
3	3	-	-	40	35	75

Purpose of Course	The main purpose of the Chemistry of Drugs and Dyes theory course is to provide and equip students with comprehensive knowledge about the chemistry, preparation, properties, and applications of medicinal drugs and dyes used in daily life and industries.
Course Objective	- To introduce the basic concepts, nomenclature, classification, and important terminology related to drugs and dyes. - To develop an understanding of the chemistry, mode of action, and therapeutic importance of various pharmaceutical compounds. - To study the methods of synthesis, structural aspects, and preparation of important drug intermediates, pharmaceuticals, and dyes. - To provide knowledge of different classes of dyes, their chemical constitution, properties, and industrial applications. - To understand the relationship between chemical structure and the activity/properties of drugs and dyes.
Pre-requisite	Students should have basic knowledge of: - General organic chemistry - Basic physical chemistry - Fundamentals of biochemistry - Basic knowledge of industrial chemistry - Laboratory skills A foundational understanding of chemistry subjects will help students better understand drug action, dye chemistry, synthesis, and industrial applications.
Course Out come	After successful completion of this course, students will be able to:



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	• CO1: Explain the fundamental concepts of drugs, their classification, pharmacological terms, drug-receptor interactions, and routes of drug administration. • CO2: Describe the chemistry, mechanism of action, therapeutic applications, and synthesis of important analgesic, antipyretic, and anti-inflammatory drugs. • CO3: Classify antibiotics and antiviral drugs, explain their sources, structures, therapeutic uses, mechanisms of action, and syntheses of selected pharmaceutical compounds. • CO4: Analyze the principles of dye chemistry, dye-fiber interactions, dyeing mechanisms, and various industrial dyeing processes. • CO5: Interpret the relationship between color and chemical constitution of dyes and evaluate different theories of color and dye behavior. • CO6: Explain the extraction, standardization, medicinal properties, and application of natural dyes, including their adaptation to continuous dyeing processes.
Course Content	Unit-1: General introduction to drugs [07 Hrs] 1.1 Definition of a drug, sources of drugs, requirements of an ideal drug, classification of drugs (based on therapeutic action) with name and structures of two important drugs in each 1.2 Definition of the medicinal terms: Pharmacon, Pharmacology, Pharmacophore, Prodrug, Half – life efficiency, LD₅₀, ED₅₀, GI₅₀, Therapeutic index. 1.3 Brief idea of the important terms: Receptors, Agonists, Antagonists, Drug-receptor interaction, Drug potency, Bioavailability, Drug toxicity, Drug addiction, Spurious drugs, Misbranded drugs, Adulterated drugs, Pharmacopoeia. 1.4 Routes of drug administration with advantages and disadvantages Unit-2: Analgesics, antipyretics and anti-inflammatory drugs [07 Hrs] 2.1 Analgesics and antipyretics 2.1.1 Opioids 2.1.2 Non-alkaloid opioids 2.1.3 Opioid peptides 2.1.4 Salicylic acid analogues 2.1.5 Aniline and p-aminophenol derivatives 2.2 Anti-inflammatory drugs 2.2.1 Mechanism of inflammation and various inflammatory conditions 2.2.2 Steroids: Prednisolone, Betamethasone 2.2.3 Sodium Diclofenac, Aceclofenac (N- Aryl anthranilic acids) (Synthesis from 2,6-dichlorodiphenyl amine) Unit-3: Antibiotics and antivirals [07 Hrs] 3.1 Definition and classification with example of each group



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	3.2 History of discovery of penicillin and structural variations in penicillin 3.2 Broad spectrum antibiotics and their therapeutic uses 3.3 Sources, structural formula and therapeutic uses of 3.3.1 Streptomycin 3.3.2 Tetracycline and Cycloseries 3.3.3 Chloramphenicol and some recent antibiotics 3.3.4 Levofloxacin (Quinolones) (Synthesis from 2,3,4- trifluoro -1- nitrobenzene) 3.4 Aciclovir/Acyclovir (Purines) with mechanism of action Unit-4: Introduction to dye chemistry and dying process [10 Hrs] 4.1 Definition, requirement of an ideal dyes (colour, solubility, linearity, co-planarity, fastness 4.2 Classification of dyes and fibers 4.3 Intermolecular forces related to dyeing, dye-fiber bonds, adsorption at surfaces 4.4 Mechanism of direct, reactive, acid, disperse and other dyes on specific fibers 4.5 Basic operation in dyeing process 4.6 Methods of dyeing Unit-5: Colour and constitution of dyes [07 Hrs] 5.1 Study of Bathochromic, Hypsochromic, Hypochromic and hyperchromic effect 5.2 Colour and chemical constitution 5.2.1 Definition of colour, colour and wavelength of radiation 5.2.2 Colour absorbed and colour visualized with respect to wavelength region. 5.2.3 Relation between colour and chemical constitution 5.3 Armstrong theory and US limitation 5.4 Witt's theory 5.5 Modern theory Unit-6: Natural dyes [07 Hrs] 6.1 Medicinal properties of natural dyes 6.2 Basics of natural dyeing 6.3 Methods of extraction of natural dyes 6.4 Standardization of natural dyes 6.5 Continuous dyeing and its adaptation for natural dyeing
Practical	-



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Reference Books	• Medicinal chemistry. Ashutosh Kar, New Age International Pvt. Ltd Publisher, 4th edition. • Burger's Medicinal Chemistry, Drug Discovery & Development. Abraham & Rotella. Wiley. • Medicinal chemistry. V.K. Ahluwalia and Madhu Chopra, CRC Press. • Drugs V.K. Ahluwalia New Age International Pvt. Ltd Publisher • Principle of medicinal chemistry. Vol 1 & 2 S. S. Kadam, K. R. Mahadik, K. G. Bothara • Chemistry of Synthetic Dyes and Pigments, Lubs H. A., Robert E, 1977, Krieger Publishing company • Chemistry of Synthetic Dyes – Vol I, Venkataraman, K., 1952, Academic Press • Chemistry of Synthetic Dyes – Vol III, Venkataraman, K., 1952, Academic Press • Colour and Chemical Constitution of Organic Dyes, Griffiths J., 1976, Academic Press • Color Chemistry –Synthesis, Properties and Applications of Dyes and Pigments, Zollinger H., 2nd ed., 1991, Weinheim – VCH • Synthetic organic chemistry, O.P. Agrawal, 2014, Krishan Prakashan • Chemistry of dyes & Principles of dyeing Vol II, V. A. Shehai, 1983, Sevak Publications • Chemistry of synthetic dyes, I. G. Vashi • Chemistry of dyes and pigments, K. M. Shah, 2013, Edu. Tech Publishing • Synthetic dyes, G. R. Chatwal, 2009, Himalaya Publishing House
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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. (Hons.) / (Hons. with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VII		Effective From	June, 2026		
Course Code	BSCH11702	Course Name	Major: Chemistry of Drugs and Dyes (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
1	-	-	2	10	15	25

Purpose of Course	The main purpose of this course is to develop laboratory skills for the identification, analysis, extraction, separation, and quality control of pharmaceutical substances and dyes.
Course Objective	• To identify important functional groups, present in drugs • To develop quantitative analytical skills • To learn separation and purification techniques • To gain experience in extraction methods • To develop laboratory competence
Prerequisite	Students should have basic knowledge of: • General chemistry, organic chemistry, analytical chemistry, and fundamental laboratory techniques, including titration, solution preparation, chromatography, and safe chemical handling.
Course Out come	After completing this course, students should be able to: • Identify functional groups in pharmaceutical compounds. • Perform pharmaceutical assays. • Use chromatography and extraction techniques effectively.
Course Content	-



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Practical	Any Three 1. Identification of functional groups in aspirin, paracetamol, sulphanilamide 2. Estimation of Ibuprofen (back titration method) 3. Estimation of Acid neutralizing capacity of a drug. 4. Separation of components of natural pigments by paper chromatography (e.g., chlorophylls) 5. Extraction of curcumin from turmeric powder 6. TLC of a mixture of dyes (safranin-T, Indigo carmine, methylene blue) 7. Industrial visit Report (Pharmaceutical/Dye)
Reference Books	• Practical organic chemistry – A. I. Vogel • Practical organic chemistry – H. Middleton. • Practical organic chemistry – O.P. Aggarwal.



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program		B.Sc. Chemistry (Honours)	
Year	2026		Version		1.0	
Semester	VII		Effective From		June, 2026	
Course Code	BSCH11703	Course Name	Major: Chemistry of Natural Products (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
3	3	-	-	40	35	75

Purpose of Course	This course aims to develop an advanced understanding of the chemistry, structural elucidation, biological significance, and pharmaceutical applications of natural products, while introducing modern analytical techniques, drug discovery approaches, and green chemistry practices in natural product research.
Course Objective	- To understand the chemistry and classification of major natural products. - To learn the isolation, purification, and structural elucidation of natural compounds. - To study the biological and medicinal importance of natural products. - To understand the structure and functions of nucleic acids. - To explore modern techniques, drug discovery applications, and green chemistry approaches in natural product research.
Pre-requisite	Students should have: Basic knowledge of organic chemistry and reaction mechanisms. Understanding of stereochemistry and structural chemistry. Familiarity with biomolecules and natural products at the undergraduate level. Basic knowledge of spectroscopic techniques. Fundamental understanding of biochemistry and medicinal chemistry concepts.
Course Out come	At the end of the course, students will be able to: CO1: Explain the classification, occurrence, chemistry, and medicinal significance of major classes of natural products. CO2: Apply isolation, purification, and structural elucidation methods for natural products using classical and spectroscopic techniques.



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	• CO3: Analyze the structure, chemistry, and biological functions of alkaloids, terpenoids, glycosides, flavonoids, steroids, and nucleic acids. • CO4: Interpret the structure and functions of DNA, RNA, nucleotides, and their role in biological processes. • CO5: Evaluate the role of natural products in drug discovery and appreciate recent advances, including marine natural products, microbial metabolites, and green chemistry approaches.
Course Content	Unit-1: Alkaloids (07 Hrs) 1.1 Introduction, occurrence and classification of alkaloids Isolation and purification methods 1.3 General methods of structural elucidation Chemistry and structure determination of: Reserpine and Morphine 1.5 Medicinal significance and physiological functions Unit-2: Terpenoids (07 Hrs) 2.1 Classification and isolation of terpenoids Isoprene rule and biosynthesis of terpenes 2.3 General methods of structure determination 2.4 Structural elucidation of: Citral and Zingiberene 2.5 Biological and medicinal importance Unit-3: Glycosides and Flavonoids (07 Hrs) Classification and medicinal importance of glycosides Cardiac glycosides and saponins Isolation and characterization of flavonoids Structural elucidation of quercetin and anthocyanidins Biological activities and applications Unit-4: Steroids (08 Hrs) Nomenclature and stereochemistry Sterols, spectral properties of steroids Chemistry of: Cholesterol and ergosterol Introduction, Structural elucidation and Synthesis of Cholanic acids (α and β both). Biological and medicinal importance Unit-5: Nucleic Acids (06 Hrs) 5.1 Purine and pyrimidine bases of nucleic acids, base pairing via H-bonding 5.2 Structure of ribonucleic acids (RNA) and deoxyribonucleic acids (DNA) 5.3 Double helix model of DNA 5.4 Chemical and enzymatic hydrolysis of nucleic acids 5.5 Overview of replication of DNA, transcription, functions of nucleotides Unit-6: Modern Aspects of Natural Products (10 Hrs) Spectroscopic methods in natural product chemistry Natural products as lead molecules in drug discovery Marine natural products Microbial metabolites Recent advances in natural products research Green chemistry approaches in natural product isolation



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Practical	-
Reference Books	• Organic Chemistry, Vol. II. By I.L. Finar • Chemistry of Natural Products by O.P. Agarwal • Natural Products: Their Chemistry and Biological Significance by Mann, Davidson, Hobbs, Banthorpe and Harborne • Chemistry of Natural Products by Krishnaswamy N. R., Universities Press • Organic Chemistry, Natural Products -Vol. 1 by O.P. Agarwal, Krishna Prakashan Media (P) Ltd • Organic Chemistry, Natural Products -Vol. 2: by O.P. Agarwal Krishna Prakashan Media (P) Ltd • Organic Chemistry of Natural Products -Vol. 1 Revised 4th Edition by Chatwal Gurdeep R. Himalaya Publishing House • Organic Chemistry of Natural Products Vol. 2: Revised 4th Edition by Chatwal Gurdeep R. Himalaya Publishing House • Stereochemistry and the Chemistry Natural Products, 5th Edition by FINAR Pearson Education India • Chemistry of Natural Products, Vol. 1 by Ashutosh Kar CBS • Natural Products: Chemistry and Applications by Sujata V. Bhat, B. A. Nagasampagi, S. Meenakshi, Narosa Publishing House • Natural Products: Chemistry, Biochemistry and Pharmacology by Goutam Brahmachari



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. (Hons.) / (Hons. with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VII		Effective From	June, 2026		
Course Code	BSCH11704	Course Name	Chemistry of Natural Products (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
1	-	-	2	10	15	25

Purpose of Course	This course aims to develop students' practical skills in the extraction, isolation, identification, estimation, and spectroscopic characterization of natural products and biomolecules. It provides hands-on training in qualitative and quantitative analytical techniques, promotes the application of green and sustainable extraction methods, and enhances competency in modern laboratory practices.
Course Objective	- To understand and perform the extraction, isolation, and estimation of natural products - To apply qualitative and quantitative analytical methods for the identification and characterization - To develop proficiency in spectroscopic techniques, particularly UV-Visible and IR spectroscopy, for the analysis and structural elucidation of natural compounds. To strengthen laboratory skills, including experimental design, data interpretation, scientific documentation, and safe laboratory practices, to prepare for research and industrial applications.
Prerequisite	Students should have a basic understanding of organic and analytical chemistry, fundamental laboratory techniques, spectroscopy, and laboratory safety practices.
Course Out come	At the successful completion of this course, students will be able to: CO1. Perform the extraction, isolation, and estimation of natural products and biomolecules using standard laboratory techniques.



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	CO2. Apply qualitative and quantitative analytical methods for the identification and characterization of natural compounds. CO3. Analyze and interpret UV–Visible and IR spectroscopic data for the structural elucidation of natural products. CO4. Demonstrate the use of green extraction techniques and adopt safe, sustainable laboratory practices. CO5. Record, interpret, and communicate experimental results effectively, preparing them for research, quality control, and industrial laboratory applications.
Course Content	-
Practical	Any three 1. Determination of Total Flavonoid Content 2. Qualitative detection of alkaloids (Three test) 3. Qualitative Analysis of DNA and Estimation Using UV Spectroscopy 4. Extraction of citral and its quantitative estimation 5. Isolation and Estimation of Cholesterol from Egg Yolk (With and without acetic anhydride) 6. Interpretation of UV–Visible, IR of selected natural products for structural elucidation. Green Extraction of Bioactive Compounds Using Ultrasound-Assisted Extraction (UAE)
Reference Books	• Instrumental Methods of Chemical Analysis – Himalaya Publishing House. • Spectroscopy – Pragati Prakashan. • Organic Spectroscopy – Narosa Publishing House. • Analytical Biochemistry – Narosa Publishing House. - Experiments in Biochemistry – Narosa Publishing House.



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. (Hons.) / (Hons. with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VII		Effective From	June, 2026		
Course Code	BSCH11705	Course Name	Major: Polymer Chemistry (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
3	3	-	-	40	35	75

Purpose of Course	To provide fundamental and applied knowledge of polymer chemistry and its industrial applications.
Course Objective	1.To understand classification and structure of polymers. 2. To study polymerization mechanisms and techniques. 3.To understand industrial applications and characterization of polymers. 4.To perform basic polymer synthesis and instrumental analysis.
Pre-requisite	Basic knowledge of Organic Chemistry, Physical Chemistry, Analytical Techniques and basic material science.
Course Outcome	CO1: Understand basic concepts of polymers. CO2: Explain polymerization reactions and techniques. CO3: Correlate structure and properties of polymers. CO4: Perform synthesis and analysis of polymers in laboratory.
Course Content	Unit-1: Introduction to Polymers [07 Hrs] 1.1 Introduction, nomenclature and classification of polymers 1.2 Thermoplastics and thermosetting polymers 1.3 Molecular weight and degree of polymerization 1.4 Glass transition temperature (T _g), Melting temperature (T _m) Unit-2: Polymerization Reactions and Mechanisms [08 Hrs] 1.1 Addition and condensation polymerization 1.2 Free radical polymerization 1.3 Ionic polymerization 1.4 Polymerization techniques Unit-3: Structure and Properties of Polymers [08 Hrs] 3.1 Structure and properties of polymers 3.2 Crystalline and amorphous polymers



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	3.3 Thermal, mechanical 3.4 Electrical properties Unit-4: Industrially Important Polymers [07 Hrs] 4.1 Importance of industrial polymers 4.2 Polyethylene 4.3 Polypropylene 4.4 PVC 4.5 Nylon 4.6 Bakelite 4.7 Epoxy and biodegradable polymer Unit-5: Polymer Processing and Characterization [07 Hrs] 5.1 Polymer additives and fillers 5.2 Plasticizers and stabilizers 5.3 Inject and Compression molding 5.4 Extrusion 5.5 Viscosity measurements and molecular weight determination 5.6 Thermal analysis 5.7 Spectroscopic methods Unit-6: Applications and Recent Developments in Polymer Chemistry [08 Hrs] 6.1 Conducting polymers 6.2 Biomedical polymers 6.3 Recycling of plastics 6.4 Green polymers and recent developments.
Practical	-
Reference Books	• Polymer Science – V. R. Gowariker, N. V. Viswanathan and Jayadev Sreedhar, New Age International Publishers, New Delhi • Polymer Chemistry – P. Bahadur and N. V. Sastry, Narosa Publishing House, New Delhi • A Textbook of Polymer Chemistry – M. S. Bhatnagar, S. Chand Publishing, New Delhi • Polymer Science and Technology – Joel R. Fried (Indian Edition), PHI Learning / Pearson India • Introduction to Polymer Science – G. S. Misra, New Age International Publishers, New Delhi • Practicals in Polymer Science: Synthesis and Qualitative & Quantitative Analysis of Macromolecules, Siddaramaiah, CBS Publishers & Distributors, New Delhi • Advanced Practical Physical Chemistry, J. B. Yadav, Goel Publishing House, Meerut • Experimental in Polymer Science, D.G.Hundiware, V.D.Athawale, U.R.Kapdi and V.V.Gite, International Publishers, New Delhi • Practical Physical Chemistry, B. Viswanathan and P. S. Raghavan, Viva Books / Narosa Publishing



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Faculty	Science		Program	B.Sc. (Hons.) / (Hons. with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VII		Effective From	June, 2026		
Course Code	BSCH11706	Course Name	Major: Polymer Chemistry (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
1	-	-	2	10	15	25

Purpose of Course	To provide practical exposure to synthesis and characterization of polymers.
Course Objective	- To synthesize simple polymers using easily available chemicals. - To perform instrumental analysis of polymer solutions - To understand basic polymer laboratory techniques.
Prerequisite	Basic laboratory knowledge of chemistry.
Course Outcome	Students will be able to synthesize and analyze simple polymer systems.
Course Content	Laboratory course based on synthesis and instrumental analysis of polymers.
Practical	Any three - Preparation of Slime (Poly Vinyl Alcohol Hydrogel) - Preparation of Urea Formaldehyde Resin. - Determination of viscosity of polymer solution using Ostwald viscometer. - Determination of pH and conductivity of polymer solution.
Reference Books	- Practicals in Polymer Science: Synthesis and Qualitative & Quantitative Analysis of Macromolecules, Siddaramaiah, CBS Publishers & Distributors, New Delhi - Advanced Practical Physical Chemistry, J. B. Yadav, Goel Publishing House, Meerut - Experimental in Polymer Science, D.G. Hundiware, V.D. Athawale, U.R. Kapdi and V.V. Gite, International Publishers, New Delhi - Practical Physical Chemistry, B. Viswanathan and P. S. Raghavan, Viva Books / Narosa Publishing



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Faculty	Science		Program	B.Sc. (Hons.) / (Hons. with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VII		Effective From	June, 2026		
Course Code	BSCH11707	Course Name	Major: Inorganic Chemistry-III (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
3	3	-	-	40	35	75

Purpose of Course	The systematic understanding of inorganic chemistry of elements and their compounds, emphasizing both theoretical principles and practical applications.
Course Objective	- To understand how ligand fields influence the electronic structure, color, and magnetism of transition metal complexes. - To study the role of metal ions in biological systems and their applications in medicine and enzymatic activity. - To analyze mechanisms, stability, and isomerism in coordination complexes with emphasis on catalysis. - To explore bonding and reactivity in clusters and organometallic compounds, highlighting industrial uses. - To train students in classical and instrumental methods for accurate inorganic analysis. - To introduce synthesis, characterization, and applications of advanced materials like nanomaterials, zeolites, and ceramics.
Pre-requisite	Basic knowledge of inorganic chemistry
Course Out come	After completion of the course, students will be able to: CO1: Apply crystal field and ligand field concepts to predict electronic structure, color, and magnetic properties of transition metal complexes. CO2: Explain the role of metal ions in biological systems and evaluate their applications in medicine and enzymatic functions. CO3: Analyze substitution and electron transfer mechanisms in coordination complexes and their applications in catalysis.



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	• CO4: Interpret bonding and stability in clusters and organometallic compounds, and demonstrate their industrial catalytic uses. • CO5: Employ classical and instrumental methods to accurately determine composition and trace elements in inorganic samples. • CO6: Synthesize and characterize advanced inorganic materials (nanomaterials, zeolites, ceramics) and relate their structure to applications.
Course Content	Unit-1: Symmetry [07 Hrs] 1.1 Introduction to symmetry (Definition, importance, elements and operations) 1.2 Point Groups 1.2 Orthogonality theorem (without proof) and its importance. 1.3 Irreducible representation, character table, direct sum, direct product, derivation of projection operator. 1.4 Character tables and their use in spectroscopy
	Unit-2: Quantum Mechanics [08 Hrs] 2.1 Review of essential mathematical concepts 2.2 Origin of the quantum theory 2.3 Postulates of quantum mechanics 2.4 Schrödinger equation; its application on some model systems viz., free-particle and particle in a box, tunneling, the harmonic oscillator, the rigid rotator, and the hydrogen atom 2.5 The variation theorem; linear variation principle; perturbation theory; applications of variational methods and perturbation theory to the helium atom 2.6 Ordinary angular momentum, generalized angular momentum, eigenfunctions, and eigenvalues
	Unit-3: Advanced Coordination Chemistry [07 Hrs] 3.1 Reaction Mechanisms: Substitution (associative, dissociative, interchange), electron transfer (inner vs. outer sphere). 3.2 Kinetics & Thermodynamics: Factors influencing stability and reactivity. 3.3 Chelate Effect: Thermodynamic basis, applications in analytical chemistry. 3.4 Isomerism: Structural, stereoisomerism, linkage isomerism. 3.5 Applications: Catalysis, analytical reagents, biological systems.
	Unit-4: Magneto Chemistry [08 Hrs] 4.1 Introduction: Definition of magnetic properties 4.2 Types of magnetic substances 4.3 Magnetic susceptibility 4.4 Anisotropy in magnetic susceptibility 4.5 Experimental arrangements for determination of magnetic susceptibility: Gouy method, Faraday method, Evans method, SQUID.
	Unit-5: Nano-chemistry and Nanotechnology [08 Hrs] 1.1 Introduction and classification 1.2 Synthesis of nanomaterials 1.3 Properties of nanomaterial 1.4 Applications of nanomaterials 1.5 Nanotechnology: safety, environmental and ethical aspects



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	Unit-6: Advanced Inorganic Materials [07 Hrs] 6.1 Zeolites: Structure, ion-exchange, catalysis. 6.2 Ceramics & Glasses: Properties, applications in technology. 6.3 Inorganic Membranes: Gas separation, fuel cells. Smart Materials: Shape-memory alloys, piezoelectric materials.
Practical	-
Reference Books	Theory Reference Books • Ligand Field Theory and Its Applications Brian N. Figgis & Michael A. Hitchman (Wiley-VCH) • Coordination Chemistry (6th Edition) Ajai Kumar (Aaryush Education) • Introduction to Coordination Chemistry Geoffrey A. Lawrance & Paul V. Bernhardt (Wiley) • Organometallics Christoph Elschenbroich (Wiley-VCH) • Analytical Chemistry: Basic Techniques and Methods Priti Malhotra (Springer) • Advanced Instrumental Analysis Kumaraswamy Gandla & M. Jagadeeswaran (2022) • Inorganic Chemistry Catherine Housecroft & Alan Sharpe (Pearson) • Concise Inorganic Chemistry J.D. Lee (Oxford University Press) • Nanotechnology: Principles and Practices by Sulabha K. Kulkarni



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. (Hons.) / (Hons. with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VII		Effective From	June, 2026		
Course Code	BSCH11708	Course Name	Major: Inorganic Chemistry-III (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
1	-	-	2	10	15	25

Purpose of Course	To provide practical knowledge and laboratory skills related to the analysis, quality evaluation.
Course Objective	- To introduce students to spectrophotometric methods for studying transition metal complexes and understanding how ligand strength affects crystal field splitting. - To familiarize students with spectrophotometric techniques for analyzing biomolecular interactions and to demonstrate the principle of cooperative oxygen binding in hemoglobin. - To train students in the synthesis of organometallic compounds and in the use of IR spectroscopy for structural characterization. - To develop skills in classical gravimetric analysis by precipitating and weighing BaSO₄ for accurate estimation of sulfate ions.
Pre-requisite	- Basic knowledge of General Chemistry and Analytical Chemistry. - Familiarity with laboratory glassware and titrimetric techniques. - Understanding of fundamental concepts of spectroscopy.
Course Outcome	Upon successful completion of the practical course, students will be able: CO1: To calculate crystal field splitting energy (Δ_o) and correlate ligand strength with spectral properties of transition metal complexes. CO2: To analyze oxygen binding behavior in hemoglobin and interpret cooperative binding using spectrophotometric data. CO3: To synthesize an organometallic compound and confirm its structure using IR spectroscopy. CO4: To perform gravimetric analysis to estimate sulfate ions accurately by precipitation and weighing of BaSO₄.



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Course Content	-
Practical	Any three 1. To Determine Δ_0 values for $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Ni}(\text{NH}_3)_6]^{2+}$ spectrophotometrically. 2. To Study cooperative binding of O_2 through spectrophotometer. 3. To Prepare and characterize ferrocene through IR spectrometer. 4. Gravimetric determination of sulfate as BaSO_4 from BaCl_2.
Reference Books	Practical Reference Books • Figgis & Hitchman, Ligand Field Theory and Its Applications • K. Hussain Reddy, Bioinorganic Chemistry • Christoph Elschenbroich, Organometallics • 4. Priti Malhotra, Analytical Chemistry: Basic Techniques and Methods.



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Faculty	Science		Program	B.Sc. (Hons.) / (Hons. with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VII		Effective From	June, 2026		
Course Code	BSCH12701	Course Name	Minor: Advanced Analytical Chemistry (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
3	3	-	-	40	35	75

Purpose of Course	To Teach the students about different spectroscopy techniques, solvent extraction and ion exclusion chromatography techniques.
Course Objective	To teach about Principle, Instrumentation and Applications of IR-NMR and Advanced Spectroscopy, On-line Analyzers, Solvent Extraction Techniques and Ion Exclusion Chromatography.
Pre-requisite	Basic knowledge of analytical chemistry, instrumental analysis, spectroscopy, and fundamental concepts of organic and inorganic chemistry.
Course Out come	At the end of the course students will be able to learn about • The History, origin, laws, principles, theories, instrumental set up, its' working mechanism, various components and it's working pattern, procedure of analysis and applications in the various field of analysis about: • IR Spectroscopy • NMR Spectroscopy • Florescence, Phosphorescence, Chemiluminescence, Turbidimetry and Nephelometry • Solvent Extraction • Ion Exclusion Chromatography
Course Content	Unit-1: Infra-Red Spectroscopy (07 Hrs) 1.1 Introduction and classification of IR region 1.2 Information provided by IR Spectroscopy 1.3 Instrumentation of IR Spectrophotometer - Single and Double Beam 1.4 Differences between IR and UV Spectrum



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1.5	Applications of IR Spectroscopy	
	Unit-2: NMR Spectroscopy	(06 Hrs)
2.1	Introduction and Basis of NMR Spectroscopy	
2.2	NMR Spectroscopy - Classification, Principle and Working	
2.3	Chemical Shift in NMR Spectroscopy	
2.4	Instrumentation and Techniques of NMR Spectroscopy	
2.5	Applications of NMR Spectroscopy	
	Unit-3: Advanced Spectroscopy Techniques	(06 Hrs)
3.1	Principle, Instrumental set up & Applications of	
3.1.1	Florescence	
3.1.2	Phosphorescence	
3.1.3	Chemiluminescence	
3.1.4	Turbidimetry	
3.1.5	Naphelometry	
	Unit-4: On-Line Analyzers	(12 Hrs)
4.1	Water quality monitoring: purpose of water quality measurement, sampling system, different sensors and analyzers	
4.2	Online pH analyzers: principle, types of different pH electrodes, application	
4.3	Online DO analyzers: principle, types of different cells and sensors, application	
4.4	ORP measurement: principle, equipment, application, ORP control	
4.5	Online FRC analyzers: principle, types of FRC sensors, applications	
4.6	On-line Turbidity, Sludge and Suspended Solid measurement: turbidity units, forward scattering transmission types, dual beam design, laser type suspended solid and sludge density sensors, scattered light detectors, backscatter turbidity analyzers	
	Unit-5: Solvent Extraction Techniques	(08 Hrs)
5.1.1	Principle and Rules	
5.1.2	Classification of extraction methods	
5.1.2.1	Chelation	
5.1.2.2	Solvation	
5.1.2.3	Ion pair formation	
5.1.2.4	Synergic extraction	
5.1.3	Methods of Extraction	
5.1.4	Factors influencing the Extraction Efficiency	
	Unit-6: Ion Exclusion Chromatography	(06 Hrs)
6.1	Principle, working procedure and applications of IEC	
6.1.1	Gel Permeation Chromatography	
6.1.2	Ion Exclusion Technique	
6.1.3	Inorganic Molecular Sieves	



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Practical	-
Reference Books	• Chemistry for Environmental Engineering and Science, C. N. Sawyer and P. L. Mc Carty, G.F. Parkin, 5th Edition, 21st Reprint, 2015, McGraw Hill Education (India) Private Limited. • Quantitative Analysis, R.A Day, A.L Underwood, 6th Edition, 1991, Prentice-Hall. • Fundamentals of Analytical Chemistry, D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, 9th Edition, Reprint 2014, Cengage Learning. • Quantitative Analysis, R.A Day, A.L Underwood, 6th Edition, 1991, Prentice-Hall. • 5.Basic Concepts of Analytical Chemistry, S.M. Khopkar, 3rd Edition, Reprint 2009, New Age International (P) Limited, Publishers. • Theory and Practicals of Engineering Chemistry, Shashi Chawla, 5th Edition, 2008, Dhanpat Rai & Co. Pvt. Ltd. • 7.Engineering Chemistry, P.C. Jain & Monica Jain, 17th Edition, Reprint 2011, Dhanpatrai Publishing Company (P) Ltd. • 8.Handbook of Analytical Instrument, R.S. Khandpur, 2nd Edition, Reprint 2009, Tata McGraw Hill Publishers. • 9.Instrumental Methods of Chemical Analysis (Analytical Chemistry), H. Kaur, 8th Edition, 2012, Pragati Prakashan. • 10.Analytical Instrumentation Handbook, Ewing's, Edited by Jack Cazes, 3rd Edition, 2005, Marcel Dekker Publisher. • 11.Instrumental Methods of Analysis, H.H. Willard, L.L. Meritt, J.A. Dean and F.A. Settle, 7th Edition, 1986, CBS Publishers. • 12.Instrumental methods of analysis, B.K. Sharma, 24th Edition, 2005, Goel Publishing House. • 13.Instrumental Analysis, D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, 11th Edition, Reprint 2012, Cengage Learning. • 14. Operation and Maintenance manuals for water, sewage and Effluent treatment plants. • 15.BIOS-Instant Notes-Analytical Chemistry, D. Kealey, P.J. Haines, 2002, Viva Books (P) Ltd. • Analytical Instrumentation, Bela G. Liptak, 1st Edition, 1994, 1st Indian Reprint, 2012, Chilton Book Company. • Theory and Practicals of Engineering Chemistry, Shashi Chawla, 5th Edition, 2008. Dhanpat Rai & Co. Pvt. Ltd.



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Faculty	Science		Program	B.Sc. (Hons.) / (Hons. with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VII		Effective From	June, 2026		
Course Code	BSCH12702	Course Name	Minor: Advanced Analytical Chemistry (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
1	-	-	2	10	15	25

Purpose of Course	To provide hands on training for IR-NMR, Advanced Spectroscopy, Water Quality Analyzers, Solvent Extraction Techniques and Ion Exclusion Chromatography Technique.
Course Objective	To Train the students about experimentation in laboratory regarding different parameters of Spectroscopy, On-line Analyzers, Solvent Extraction and Chromatography.
Prerequisite	Basic knowledge of analytical chemistry, water quality parameters, volumetric analysis, laboratory safety, preparation of standard solutions, and operation of common analytical instruments.
Course Out come	At the end of this course, students will be able to determine Turbidity, Suspended Solids of water sample, different water quality parameters like Free Residual Chlorine, Dissolved Oxygen, IR-NMR and Chromatography related hands on training, etc.
Course Content	---
Practical	Any three Determination of Turbidity in water sample. Determination of Suspended Solids in water sample. Determination of Free Residual Chlorine in water sample. Determination of Dissolved Oxygen in water sample.
Reference Books	Standard Methods for Examination of Water & Wastewater, Andrew D. Eaton, Lenore S. Clesceri, Eugene W. Rice, Arnold Greenberg, 23 rd Edition, 2017. published by APHA, AWWA. WEF. Official Methods of Analysis, Dr. William Harwitz, Dr. George W Latimer, 18 th Edition, 2005, published by Association of Officiating Analytical



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Chemists (AOAC).

Analytical Chemistry, H. Kaur, 1st Edition, 2013, Pragati Prakashan.

Operation and Maintenance manuals for water, sewage and Effluent treatment plants.

S.K.Bhasin, Sudha Rani, Laboratory Manual on Engineering Chemistry;3rd Edition, 2011, Dhanpatrai Publishing Company.

Theory and Practicals of Engineering Chemistry, Shashi Chawla, 5th Edition, 2008, Dhanpat Rai & Co. Pvt. Ltd.



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Faculty	Science		Program	B.Sc. (Hons) (Chemistry)		
Year	2026		Version	1.0		
Semester	VII		Effective From	June, 2026		
Course Code	BSCH15701	Course Name	SEC: Research Methodology-I (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
2	2	-	-	25	25	50

Purpose of Course	This course aims to develop students' understanding of the principles and practices of scientific research.
Course Objective	- To understand the concepts, objectives, scope, and types of scientific research. - To develop skills in identifying research problems and formulating hypotheses. - To familiarize students with scientific literature, reference management, and laboratory practices. - To learn methods of data collection, statistical analysis, and scientific communication. - To understand research ethics, intellectual property rights, and recent advances in chemical research.
Pre-requisite	Students should have: - Basic knowledge of chemistry and scientific methods. - Familiarity with documentation process. - Fundamental knowledge of computer applications and internet resources for scientific information.
Course Out come	At the end of the course, students will be able to: CO1: Explain the concepts, objectives, types, and methodology of scientific research. CO2: Apply literature survey techniques, formulate research problems, and design scientific experiments. CO3: Analyze experimental data using statistical methods and software tools for scientific interpretation. CO4: Prepare scientific reports, research papers, posters, and presentations



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	using appropriate citation styles. CO5: Demonstrate ethical research practices, understand Intellectual Property Rights, and appreciate emerging trends in chemical research.
Course Content	Unit-1: Fundamentals of Research Methodology (08 Hrs) 1.1 Meaning, objectives, scope, and significance of research 1.2 Types of research: Basic, Applied, Experimental, Analytical, Interdisciplinary 1.3 Research process and scientific method 1.4 Identification and formulation of research problems 1.5 Research objectives and hypothesis 1.6 Variables, research design, and experimental planning Unit-2: Literature Survey, Experimental Design and Lab. Practices (08 Hrs) 2.1 Sources of scientific literature: Journals, books, patents, conference proceedings, and online databases 2.2 Literature search using Google Scholar, Scopus, Web of Science, SciFinder 2.3 Reference management software: Mendeley, Zotero, and EndNote 2.4 Experimental design and sampling methods 2.5 Good Laboratory Practices (GLP) 2.6 Laboratory safety, chemical handling, risk assessment, calibration, QA/QC Unit-3: Data Analysis and Scientific Communication (07 Hrs) 3.1 Collection, organization, and presentation of experimental data 3.2 Accuracy, precision, and error analysis 3.3 Descriptive statistics: Mean, median, mode, standard deviation, and variance 3.4 Regression, correlation, and hypothesis testing 3.5 Use of MS Excel and Origin for data analysis 3.6 Scientific writing: Research papers, dissertations, abstracts, posters, and oral presentations 3.7 Citation styles and reference management 3.8 Peer-review and publication process Unit-4: Research Ethics, IPR and Emerging Trends (07 Hrs) 4.1 Research ethics and responsible conduct of research 4.2 Plagiarism, fabrication, falsification, and publication ethics 4.3 Authorship, copyright, and data integrity 4.4 Intellectual Property Rights (IPR): Patents, trademarks, copyrights, and patent filing 4.5 Green chemistry and sustainable research 4.6 Nanotechnology, computational chemistry, artificial intelligence in chemistry 4.7 Current trends and future perspectives in chemical research



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Practical	-
Reference Books	• C. R. Kothari, Research Methodology: Methods and Techniques. • Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners. • Wayne C. Booth, Gregory G. Colomb & Joseph M. Williams, The Craft of Research. • Day, R. A. & Gastel, B., How to Write and Publish a Scientific Paper. • Montgomery, D. C., Design and Analysis of Experiments. • Miller, J. N. & Miller, J. C., Statistics and Chemometrics for Analytical Chemistry. • ICH Guidelines on Good Laboratory Practices (GLP). • WIPO publications on Intellectual Property Rights. • ACS Style Guide for Scientific Writing.



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Faculty	Science		Program	B.Sc. Chemistry (Hons with Research)		
Year	2026		Version	1.0		
Semester	VII		Effective From	June, 2026		
Course Code	BSCH18701	Course Name	Research Project-I: (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
2	2	-	-	25	25	50

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. Chemistry (Hons with Research)		
Year	2026		Version	1.0		
Semester	VII		Effective From	June, 2026		
Course Code	BSCH18702	Course Name	Research Project-I: (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
4	-	-	8	40	60	100



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Purpose of Course	This course aims to develop students' understanding of the principles and practices of scientific research.
Course Objective	- To understand the concepts, objectives, scope, and types of scientific research. - To develop skills in identifying research problems and formulating hypotheses. - To familiarize students with scientific literature, reference management, and laboratory practices. - To learn methods of data collection, statistical analysis, and scientific communication. - To understand research ethics, intellectual property rights, and recent advances in chemical research.
Pre-requisite	Students should have: - Basic knowledge of chemistry and scientific methods. - Familiarity with documentation process. - Fundamental knowledge of computer applications and internet resources for scientific information.
Course Outcome	At the end of the course, students will be able to: CO1: Explain the concepts, objectives, types, and methodology of scientific research. CO2: Apply literature survey techniques, formulate research problems, and design scientific experiments. CO3: Analyze experimental data using statistical methods and software tools for scientific interpretation. CO4: Prepare scientific reports, research papers, posters, and presentations using appropriate citation styles. CO5: Demonstrate ethical research practices, understand Intellectual Property Rights, and appreciate emerging trends in chemical research.
Course Content	Unit-1: Fundamentals of Research Methodology (08 Hrs) 1.1 Meaning, objectives, scope, and significance of research 1.2 Types of research: Basic, Applied, Experimental, Analytical, Interdisciplinary 1.3 Research process and scientific method 1.4 Identification and formulation of research problems 1.5 Research objectives and hypothesis 1.6 Variables, research design, and experimental planning Unit-2: Literature Survey, Experimental Design and Lab. Practices (08 Hrs) 2.1 Sources of scientific literature: Journals, books, patents, conference proceedings, and online databases 2.2 Literature search using Google Scholar, Scopus, Web of Science, SciFinder 2.3 Reference management software: Mendeley, Zotero, and EndNote 2.4 Experimental design and sampling methods 2.5 Good Laboratory Practices (GLP) 2.6 Laboratory safety, chemical handling, risk assessment, calibration, QA/QC



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	Unit-3: Data Analysis and Scientific Communication (07 Hrs) 3.1 Collection, organization, and presentation of experimental data 3.2 Accuracy, precision, and error analysis 3.3 Descriptive statistics: Mean, median, mode, standard deviation, and variance 3.4 Regression, correlation, and hypothesis testing 3.5 Use of MS Excel and Origin for data analysis 3.6 Scientific writing: Research papers, dissertations, abstracts, posters, and oral presentations 3.7 Citation styles and reference management 3.8 Peer-review and publication process Unit-4: Research Ethics, IPR and Emerging Trends (07 Hrs) 4.1 Research ethics and responsible conduct of research 4.2 Plagiarism, fabrication, falsification, and publication ethics 4.3 Authorship, copyright, and data integrity 4.4 Intellectual Property Rights (IPR): Patents, trademarks, copyrights, and patent filing 4.5 Green chemistry and sustainable research 4.6 Nanotechnology, computational chemistry, artificial intelligence in chemistry 4.7 Current trends and future perspectives in chemical research
Practical	-
Reference Books	• C. R. Kothari, Research Methodology: Methods and Techniques. • Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners. • Wayne C. Booth, Gregory G. Colomb & Joseph M. Williams, The Craft of Research. • Day, R. A. & Gastel, B., How to Write and Publish a Scientific Paper. • Montgomery, D. C., Design and Analysis of Experiments. • Miller, J. N. & Miller, J. C., Statistics and Chemometrics for Analytical Chemistry. • ICH Guidelines on Good Laboratory Practices (GLP). • WIPO publications on Intellectual Property Rights. • ACS Style Guide for Scientific Writing.



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SEM - 8

DETAILED CURRICULUM
(W.E.F. 2026-27)



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Faculty	Science		Program	B.Sc. Chemistry (Hons) / (Hons with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VIII		Effective From	June, 2026		
Course Code	BSCH11801	Course Name	Major: Agricultural Chemistry (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
3	3	-	-	40	35	75

Purpose of Course	To focus on the study of soil properties. fertility, irrigation water quality and nutrient management to improve agriculture crop productivity. The course helps students to understand how soil health directly impacts agricultural output and sustainability.
Course Objective	- To impart knowledge on concepts of soil chemistry, chemical reactions, ion exchange reactions - To gain and understand the concepts of clay minerals and soil colloids - To explain the importance of organic matter and humus in improving soil fertility - To impart knowledge on the ability of a soil in supplying nutrients to plants for sustainable agriculture. - To understand the importance of soil fertility - To study the role of essential nutrients in plant growth - To learn about the criterias for irrigation water quality suitable for agriculture crop.
Pre-requisite	This syllabus requires a basic understanding of chemistry and biology and familiarity with basic soil science and agriculture. including soil composition. soil formation, and plant nutrients, is also helpful.



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Course Out come	After successful completion of this course, students will be able to: CO1: Explain the principles of soil chemistry, soil formation, and the properties of soil constituents. CO2: Analyze soil chemical reactions, soil pH, ion exchange, and their effects on nutrient availability. CO3: Describe the role of soil organic matter and humus in maintaining soil fertility and productivity. CO4: Evaluate soil as a source of plant nutrients and explain the functions and uptake of essential plant nutrients. CO5: Assess irrigation water quality using salinity, sodicity, alkalinity, and permeability parameters for sustainable crop production.
Course Content	Unit-1: Soil Chemistry (07 Hrs) 1.1 Introduction and importance of soil 1.2 Soil formation: physical, chemical, biological weathering and pedogenesis 1.3 Soil: Clay Minerals- classification and properties 1.4 Soil Aggregates - formation, soil colloids and properties 1.5 The soil profile and types of soil and soil indicator plants Unit 2 Soil Chemical Reactions (08 Hrs) 2.1 Soil chemical reactions and importance 2.2 Factors controlling soil reactions 2.3 Soil pH and types of acidity 2.4 Influence of soil reaction on availability of nutrients 2.5 Adsorption and Ion Exchange: Cation and Anion Exchange Unit-3: Soil Organic Matter (10 Hrs) 3.1 Sources and composition 3.2 Factors affecting SOM 3.3 Role of SOM and importance of SOM in soil fertility 3.4 Humus/SOM: Formation - (i) Decomposition (ii) Synthesis and Properties 3.5 Humus/SOM: Decomposition- Reactions, Products and Factors Affecting 3.6 Fractionation of Humus/SOM 3.7 C: N Ratio and it's Significance - Composition of Green Plant Materials Unit-4: Soil as a Source of Plant Nutrients (06 Hrs) 4.1 Plant growth factors 4.2 Crop production factors 4.3 Soil qualities and characteristics affecting crop growth 4.4 Soil Fertility-essential and beneficial elements Unit-5: Plant Nutrition Chemistry (06 Hrs) 5.1 Plant nutrients 5.2 Concentration and plants yield 5.3 Functions of nutrients in plants 5.4 Forms of elements in mineral soil 5.5 Forms of nutrient element absorbed by plants



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	Unit-6: Assessment of Irrigation Water Quality (08 Hrs) 6.1 Irrigation water quality criteria 6.2 Salinity hazard 6.3 Sodium hazard 6.4 Salt index 6.5 Alkalinity hazard 6.6 Permeability hazard 6.6 Specific ion toxicity hazards
Practical	-
Reference Books	• Kaur H., 2015. Environmental Chemistry, Pragati Prakashan. • Boul, S.W., Hole, F.D. and Mc Cracken, R.J. 1995. Soil Genesis and Classification. Affiliated East West Press Pvt. Ltd. New Delhi. • Dilip Kumar Das. 2004. Introductory Soil Science. Kalyani Publishers, New Delhi. • Fundamentals of Soil Science , 2002. ISSS Publication, IARI, New Delhi. • Miller, C.E., and Turk, L.M. 2006. Fundamentals of Soil Science , Biotech Books, Trinagar, New Delhi



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. Chemistry (Hons) / (Hons with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VIII		Effective From	June, 2026		
Course Code	BSCH11802	Course Name	Major: Agricultural Chemistry (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
1	-	-	2	10	15	25

Purpose of Course	To Provide Hands on Training to students for Analysis of Agricultural Soil, Water and Plant sample for different Quality Parameters to determine their effect on Agriculture Crop Yield.
Course Objective	• To Determine different quality parameters to decide the irrigation water is suitable for agriculture crop production purpose. • To Determine different quality parameters to decide the soil is suitable for agriculture crop production purpose. • To justify the proper plant growth by checking certain parameters of plants.
Prerequisite	Basic laboratory skill
Course Out come	● Students will be able to do analysis in chemistry laboratory to check the soil quality is suitable for agricultural purpose. ● Students will be able to do analysis in chemistry laboratory to check the water quality is suitable for crop irrigation purpose. ● Students will be able to check the plant growth.
Course Content	-
Practical	Any three 1. Determination of Cation Exchange Capacity (CEC) of agriculture soil sample. 2. Determination of C: N Ratio of agricultural soil sample. 3. Determination of moisture content of agricultural soil sample. 4. Determination of pH of agricultural soil sample and decide soil type. 5. Determination of electrical conductivity of saline soil sample to decide soil type and effect on agriculture crop. 6. Determination of Electrical Conductivity of Irrigation water sample and decide Salinity Classs of Water Sample. 7. Determination of pH of Irrigation Water Sample.



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	8. Determination of Chlorophyll Content of Green Plant Sample.
Reference Books	● Recent Advances in Environmental Analysis (water, soil and air)- B.S. Yadav (1 st Edition), Adhyayan Publishers. ● Analytical Techniques in Agriculture, Biotech and Environment Engineering- A. Nag , Eastern Economy Edition, Prentice hall of India Pvt. Ltd; New Delhi, 2006. ● Standard methods for the Examination of Water and Wastewater. A.D. Eaton. L.S. Clesceri, E.W. Rice, A. Greenberg, 24th Edition. 2024. APHA, AWWA, WEF. ● Analytical Chemistry, H. Kaur, 1st Edition, 2013, Pragati Prakashan.

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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. Chemistry (Hons) / (Hons with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VIII		Effective From	June, 2026		
Course Code	BSCH11803	Course Name	Major: Food and Dairy Chemistry (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
3	3	-	-	40	35	75

Purpose of Course	The Food and Dairy Chemistry course is designed to give students a deep scientific understanding of food at the molecular level and to provide fundamental knowledge of milk chemistry, dairy products, quality control, and analytical methods used in the dairy industry.
Course Objective	- To understand the basics of food nutrients and its classification - To learn the various cooking process. - To study the food additives and flavoring agents. - To understand the chemical composition of milk. - To study the chemistry of dairy products. - To learn methods of milk analysis and quality control. - To understand dairy processing and preservation techniques.
Pre-requisite	Basic knowledge of Organic Chemistry, Biochemistry, and Food Chemistry.



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Course Outcome	After completion of the course, students will be able to: • CO-1: Gain understanding of food's chemical composition (macromolecules, nutrients, additives) and their importance in cooking, nutrition, and medical use. • CO-2: Apply chemistry knowledge to cooking processes, optimizing nutrition and sensory quality. • CO-3: Evaluate nutrient classification and sources to make informed dietary choices for health. • CO-4: Critically analyze food additives in preservation and flavor, considering health impacts. • CO-5: Explain the composition and properties of milk. • CO-6: Understand the chemistry of dairy products. • CO-7: Perform basic analytical tests on milk and dairy products. • CO-8: Apply quality control measures in dairy industries.
Course Content	Unit-1: Basics of food nutrients and its classification (08 Hrs) 1.1 Understanding the role of carbohydrates, proteins, and lipids in food systems, 1.2 Chemical structures and functions of macromolecules. 1.3 Carbohydrate-rich foods: Wheat, rice, potato, sugar, etc. 1.4 Protein-rich foods: Egg, milk, meat, fish, pulses, etc. 1.5 Fat-rich foods: Oil, ghee, butter, groundnut, etc. 1.6 Vitamins rich foods: Fruits, green leafy vegetables
	Unit-2: Chemistry of Cooking (07 Hrs) 2.1 Physical and Chemical changes 2.2 Stability of nutrients during cooking 2.3 Microwave cooking 2.4 Food sterilization 2.5 Chemistry of spices and herbs 2.6 Safety protocols and best practices in kitchen chemistry.
	Unit-3: Food Additives (08 Hrs) 3.1 Adulterants, and contaminants 3.2 Food preservatives like benzoates, propionates, sorbates, disulphites 3.3 Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose, and sodium cyclamate. 3.4 Flavors: Vanillin, alkyl esters (fruit flavors), and monosodium glutamate. 3.5 Artificial food colorants: Coal tar dyes and non-permitted colors and metallic salts. 3.6 Safety considerations and regulatory aspects of food additives in food production
	Unit-4: Composition and Chemistry of Milk (08 Hrs) 4.2 Definition and importance of milk 4.3 Chemical composition of milk 4.3 Water in milk 4.4 Milk proteins: Casein and whey proteins 4.5 Milk carbohydrates: Lactose 4.6 Milk fats and phospholipids 4.7 Vitamins and minerals in milk 4.8 Physical and chemical properties of milk



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	Unit-5: Dairy Products and Processing (07 Hrs) 5.1 Chemistry of cream and butter 5.2 Cheese: manufacture and chemistry 5.3 Yogurt and fermented milk products 5.4 Ice cream chemistry 5.5 Condensed milk and milk powder 5.6 Pasteurization and sterilization 5.7 Homogenization of milk
	Unit-6: Milk Analysis and Quality Control (07 Hrs) 6.1 Sampling of milk 6.2 Determination of acidity of milk 6.3 Determination of fat content 6.4 Detection of common adulterants in milk 6.5 Quality standards of milk 6.6 Food safety regulations for dairy products
Practical	-
Reference Books	• The Science of Cooking: Understanding the Biology and Chemistry behind Food and Cooking; Joseph J. Provost, Keri L. Colabroy, Brenda S. Kelly, Mark A. Wallert; ISBN: 978-1-118-67420-8. • Essential Guide To Food Additives by Victoria Emerton and Eugenia Choi https://books.rsc.org/books/edited-volume/21/Essential-Guide-to-Food-Additives • Food Additives Data Book by Jim Smith and Lily Hong-Shum. • Food Additives by A. Larry Branen, P. Michael Davidson, Seppo Salminen and John H. Thorngate III • Food and Nutrition Handbook for Extension Workers by Ministry of Agriculture, Animal Industry and Fisheries. • Textbook on Nutrition & Dietetics for Post Basic BSc Nursing Students by I. Clement. • Outlines of Dairy Technology – Sukumar De, Oxford University Press, New Delhi. • Milk and Milk Products – C. P. Ananthakrishnan, New India Publishing Agency, New Delhi. • Handbook of Food Analysis – S. Ranganna, Tata McGraw-Hill Publishing Company, New Delhi. • Dairy Chemistry and Animal Nutrition – M. C. Jain, Kalyani Publishers, New Delhi. • Textbook of Dairy Chemistry – S. K. Gupta, Kalyani Publishers, New Delhi.



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Faculty	Science		Program	B.Sc. Chemistry (Hons) / (Hons with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VIII		Effective From	June, 2026		
Course Code	BSCH1180	Course Name	Major: Food and Dairy Chemistry (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial(T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
1	-	-	2	10	15	25

Purpose of Course	To provide practical knowledge and laboratory skills related to the analysis, quality evaluation, and testing of Carbohydrate, Fat Rancidity, milk and dairy products using standard analytical methods.
Course Objective	- To introduce students to the basic chemical tests used for identifying carbohydrates in food samples. - To emphasizes understanding fat spoilage and applying chemistry to ensure food safety. - To familiarize students with basic dairy chemistry laboratory techniques. - To develop skills in the analysis of milk and dairy products. - To perform quality control tests for milk and detect common adulterants. - To understand analytical methods used in dairy industries. - To interpret experimental results related to milk composition and quality.
Prerequisite	- Basic knowledge of general chemistry and analytical chemistry. - Understanding of fundamental concepts of food chemistry.
Course Outcome	Upon successful completion of the practical course, students will be able to: CO1: Students will be able to identify carbohydrates in common food samples using simple chemical tests (iodine for starch, Benedict's for reducing sugars). CO2: Students will be able to detect rancidity in fats/oils through sensory evaluation and peroxide value testing. CO3: Perform analytical tests and determine physicochemical properties of milk and dairy products. CO4: Detect milk adulterants and operate basic dairy analysis instruments safely and accurately. CO5: Analyze, interpret, and report dairy quality control data while understanding quality assurance and food safety practices in the dairy industry.



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Course Content	Any three 1. Determination of Carbohydrate identification using iodine solution for starch and Benedict's solution for reducing sugars. 2. To check the fat rancidity: Perform odor and simple peroxide value test of stored butter/oil sample. 3. Determination of acidity of milk by titrimetric method 4. Detection of common adulterants in milk
Reference Books	• Food Chemistry II: A Practical Manual - Prof. Shalini Sehgal & team • Textbook of Food Chemistry - Dr. Gayatri Vaidya • Practical Dairy Chemistry – A. K. Patra, CBS Publishers & Distributors, New Delhi. • Handbook of Food Analysis – S. Ranganna, Tata McGraw-Hill Publishing Company, New Delhi. Laboratory Manual in Dairy Chemistry – Indian Council of Agricultural Research (ICAR), New Delhi



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. Chemistry (Hons) / (Hons with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VIII		Effective From	June, 2026		
Course Code	BSCH11805	Course Name	Major: Organic Synthesis and Mechanism (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
3	3	-	-	40	35	75

Purpose of Course	To develop a thorough understanding of advanced organic reaction mechanisms, stereochemistry, aromaticity, and oxidation–reduction reactions, enabling students to analyze and apply these concepts in organic synthesis and research.
Course Objective	- To understand advanced organic reaction mechanisms and rearrangements. - To study methods for determining reaction mechanisms and isotope effects. - To explain oxidation and reduction reactions in organic chemistry. - To understand the Hammett equation and aromaticity concepts. - To develop knowledge of stereochemistry and its applications.
Pre-requisite	Basic knowledge of organic chemistry, reaction mechanisms, chemical bonding, stereochemistry, and fundamental concepts of physical chemistry.
Course Out come	After successful completion of this course, students will be able to: CO1: Explain advanced organic reaction mechanisms and rearrangement reactions. CO2: Analyze reaction mechanisms using kinetic, stereochemical, and isotopic evidence. CO3: Apply oxidation and reduction methods in organic synthesis. CO4: Interpret the Hammett equation and concepts of aromaticity. CO5: Explain stereochemistry and predict the behavior of stereoisomers in organic reactions.
Course Content	Unit-1: Rearrangement/Reaction (10 Hrs) 1.1 Rearrangement to electron deficient carbon: Pinacol-pinacolone, Wagner - Meerwein, Benzilic acid, Wolf Arndt-Eisterts synthesis 1.2 Rearrangement to electron deficient Nitrogen: Hofmann, Curtius, Schmidt,



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	1.3 Rearrangement to electron deficient Oxygen: Baeyer Villiger 1.4 Rearrangement to electron rich carbon: Favorskii, Witting 1.5 Aromatic rearrangements: Fries, Claisen and Benzidine free radical 1.6 Dakin reaction 1.7 Reformatsky reaction 1.8 Cannizzaro reaction 1.9 Dieckmann reaction, 1.10 Perkin reaction
	Unit-2: Methods of Determining Mechanisms and Isotope Effects (05 Hrs) 2.1 Introduction 2.2 Methods of determining mechanism 2.2.1 Determination of the products formed 2.2.2 Study of intermediate formed 2.2.3 Study of catalyst 2.2.4 Stereochemical Evidence 2.2.5 Kinetic Evidence 2.2.6 Isotope Labelling 2.3 Isotopic Effects
	Unit-3: Oxidation and Reduction (10 Hrs) 3.1 Oxidation of alcohol: Chromic acid, Chromium (VI)oxide, pyridine complexes, Manganese (IV)oxide and silver carbonate 3.2 Oxidation of ketones; conversion into unsaturated ketones, oxidation of ketols 3.3 Oxidation with ruthenium tetroxide, Oxidation with thallium(III)nitrate, 3.4 Oppenauer oxidation 3.5 Catalytic hydrogenation, selectivity of reaction of functional groups, 3.6 Homogeneous hydrogenation, 3.7 Reduction by dissolving metals: reduction with metal and acid reduction of carbonyl compounds 3.8 Reduction with Metal in liquid ammonia (Birch reduction) 3.9 Reductive fission of alcohols and halides 3.10 Reduction by hydride transfer reagents: 3.11 Other methods : Wolf Kishner reduction, desulphurization of thioacetals
	Unit-4: Hammett Equation its modification and applications (08 Hrs) 4.1 Linear free energy relationship 4.2 Hammett equation 4.3 Derivation of Hammett equation 4.4 Physical meaning of σ and ρ 4.5 Significance and modification of ρ 4.6 Applications of Hammett plots 4.7 Deviation from linearity 4.8 Thermodynamic implication of Hammett equation
	Unit-5: Aromaticity (06 Hrs) 5.1 Aromaticity and Huckel's rule



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	5.2 Aromaticity in benzenoid and non-benzenoid compounds 5.3 Annulenes, fullerenes 5.4 Alternant and non-alternant hydrocarbons energy level of molecular orbitals 5.5 Anti aromaticity, homo aromaticity, non-aromatic compounds Unit-6: General Stereochemistry (06 Hrs) 6.1 Chirality and Fischer projection 6.2 Optical isomerism in biphenyls and allenes 6.3 Concept of Pro-stereoisomerism and Asymmetric synthesis 6.4 Conformation of a few acyclic molecules (alkanes, haloalkanes) 6.5 Conformation of cyclic systems having one and two sp^2 carbon atoms.
Practical	-
Reference Books	References: • Mechanism and structure in organic chemistry, E.S. Gould, Holt, Rinehart and Winston. • Advanced organic chemistry, J. March. • Physical organic chemistry, J. Hine. • Advanced organic chemistry Part A-Carey F. A. and Sundberg R. J. (Plenum Press). • Organic Chemistry, Clayden, Greeves, Warren and Wothers [Oxford Press]. • Designing organic synthesis, S. Warren, Wiley • Some modern methods of organic synthesis, W. Carruthers, Cambridge Univ. Press • Modern synthetic reaction, H.O. House, W. A. Benjamin. • Advanced organic reactions, reactions, mechanisms and structure, J. March, Wiley. • Principles of organic synthesis, R.O.C. Norman and J. M. Coxon, Blackie Academic and Professional. • Advanced organic chemistry part-B, F, A. Carrey and R. J. Sundberg, Plenum • Organic reaction and their mechanisms, P. S. Kalsi, New Age International Publishers. • Protective groups in organic synthesis, T. W. Greene and P. G. M. Wuts, IInd Edition, John Wiley and Sons 1991. • Organic synthesis: the disconnection approach, Sturant Warren, John Wiley and Sons. • Mechanism and structure in organic chemistry, E.S. Gould, Holt, Rinehart and Winston.



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. Chemistry (Hons) / (Hons with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VIII		Effective From	June, 2026		
Course Code	BSCH11806	Course Name	Major: Organic Synthesis and Mechanism (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
1	-	-	2	10	15	25

Purpose of Course	Purpose of this course is to teach the students about organic synthesis and reactions as well as to develop the laboratory skills.
Course Objective	- To synthesize organic compounds. - To study important organic reactions. - To develop practical laboratory skills. - To estimate components in organic mixtures accurately.
Prerequisite	Basic knowledge of organic chemistry, understanding of common organic reactions
Course Out come	CO1: Synthesize organic compounds using standard laboratory methods. CO2: Perform important organic reactions safely and accurately. CO3: Purify and characterize synthesized compounds. CO4: Estimate the composition of organic mixtures using quantitative analysis.
Course Content	--
Practical	Any three - Organic synthesis of methyl orange - Preparation of eosin from phthalic acid - Preparation of p-chlorotoluene from p-toluidine - Estimation of mixture (Acid + Amide) - Estimation of mixture (Acid + Ester)
Reference Books	- Vogel's Textbook of Practical Organic Chemistry – A. I. Vogel. - Practical Organic Chemistry – F. G. Mann & B. C. Saunders. - A Textbook of Practical Organic Chemistry – A. I. Vogel. - Practical Organic Chemistry – O. P. Agarwal. - Practical Chemistry – V. K. Ahluwalia & Sunita Dhingra. - Advanced Practical Organic Chemistry – Jagdamba Singh & Jaya Singh.



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. Chemistry (Hons) / (Hons with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VIII		Effective From	June, 2026		
Course Code	BSCH11807	Course Name	Major: Physical Chemistry - III (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
3	3	-	-	40	35	75

Purpose of Course	This Course Paper proposes to teach about: different aspects of Chemical Kinetics and Thermodynamics.
Course Objective	Students will be able to learn: • Order of reaction, theories of reaction rate • Kinetics of complex and chemical reactions • Applications of chemical kinetics • Thermodynamics equilibrium and processes, work and energy, entropy, enthalpy, free energy, laws of thermodynamics, important equations their derivations and applications.
Prerequisite	• Basic concepts of chemistry (atoms, molecules, chemical reactions). • Knowledge of physical chemistry (mole concept, concentration, gas laws). • Basic chemical equilibrium concepts. • Basic mathematics (algebra, logarithms, simple graphs). • Basic physics (heat, work, energy, temperature, and pressure).
Course Out come	At the end of this course paper students will be able to deal with Order, molecularity, rate of chemical reactions – factors affecting it, kinetics and theories of complex and chemical reactions and applications in various fields, objectives and limitations of thermodynamic processes, laws of thermodynamics and its' significance, enthalpy, entropy, free energy, various isotherms, equations and their applications.
Course Content	Unit-1: Order and Molecularity of Chemical Reaction (06 Hrs) 1.1 Molecularity of reaction 1.2 Order of reaction with examples 1.2.1 Zero order reactions and Kinetics 1.2.2 Pseudo first order reaction

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1.2.3	First order reactions and Kinetics	
1.2.4	Second order reactions and Kinetics	
1.2.5	Third order reactions and Kinetics	
1.2.6	Kinetics of N th order reactions	
1.3	Half life and mean life	
1.4	Order and molecularity of simple reactions	
1.5	Order and molecularity of complex reactions	
1.6	Numerical	
Unit-2: Theories of Reaction Rate		(07 Hrs)
2.1	Collision theory of reaction rate and limitation	
2.2	Effect of increase of temperature on reaction rate	
2.3	Transition state theory	
2.4	Activation energy and catalyst	
2.5	Lindemann mechanism	
2.6	Numerical	
Unit-3: Kinetics of Complex and Chemical Reactions		(08 Hrs)
3.1	Consecutive reactions	
3.2	Parallel or side reactions	
3.3	Reversible or opposing reactions	
3.4	Michaaelis-Menten relationship for Enzyme reaction	
3.5	Chain reactions	
3.6	Branching reactions	
3.7	Explosive reactions	
3.8	Influence of ionic strength	
3.9	Applications of Chemical Kinetics	
3.10	Numerical	
Unit-4: Thermodynamics-I		(06 Hrs)
4.1	Introduction	
4.2	Objectives and limitations	
4.3	Types of systems and properties	
4.4	State functions and thermodynamics equilibrium	
4.5	Thermodynamic processes	
4.6	The nature of energy, work, heat and temperature	
4.7	Internal energy: characteristics	
4.8	Exothermic and endothermic reactions	
Unit-5: Thermodynamics-II		(12 Hrs)
5.1	The Zeroth law of thermodynamics	
5.2	First law of thermodynamics and its' significance	
5.3	P-V work and Enthalpy	
5.4	Standard heat enthalpy and enthalpy of formation	
5.5	Applications of first law of thermodynamics	
5.6	Bond energy and enthalpy	
5.7	The spontaneous process and criterion of spontaneity	
5.8	The Entropy and entropy change	
5.9	Second law of thermodynamics	
5.10	Free energy and standard free energy changes and significance	



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	5.1.1 Absolute entropies and third law of thermodynamics Unit-6: Thermodynamics-III (06 Hrs) 6.1 Free Energy: 6.1.1 Helmholtz Free Energy 6.1.2 Gibb's Free Energy 6.2 Free Energy Functions: 6.2.1 Helmholtz Free Energy Functions 6.2.2 Gibb's Free Energy Functions 6.3 Van't Hoff Isotherm 6.3.1 Derivation of the relation between ΔG and K_p 6.4 Clapeyron Equation: Derivation 6.4.1 Solid-liquid equilibrium 6.4.2 Liquid-gas equilibrium 6.5 Clapeyron-Clausius Equation: Integration form 6.5.1 Applications: Determination of M.W. from 6.5.1.1 Molal elevation constant 6.5.1.2 Molal depression constant 6.6 Numerical
Practical	-
Reference Books	• Gurdeep Raj ,Advanced Physical Chemistry; 20th Edition, (2017), Krishna Prakashan, • Arun Bahl, B.S. Bahi, G.D. Tuli; Essentials of Physical Chemistry; 1st Revised Edition (2008), Reprint (2016), S. Chand and Company Limited. • K.K. Sharma and L.K. Sharma, Textbook of Physical Chemistry; 4th Edition. (2005), Vikas Publication, • Dr. Hemangi Desai ,et.al,Physical Chemistry for S.Y.B.Sc. Sem-4; 1st Edition,(2017), New Popular Prakashan, • P.Bahadur and P. Bahadur, Text Book of Chemistry; 6th Edition, 2001, Krishna Prakashan Media(P) Ltd. • M.V. Sangaranarayanan, V. Mahadevan, Textbook of Physical Chemistry, 1st Edition, 2011, University Press (India) Pvt. Ltd. • 7. Late B.R. Puri, L.R. Sharma, Madan S. Pathania, Principles of Physical Chemistry; 1st Revised Edition, 2013, Vishal Publishing Company. • P.C. Jain and Monica Jain, Text Book of Engineering Chemistry, 2016,Dhanpatrai Publishing Company. • Dr. Rajshree Khare, Text Book of Engineering Chemistry, Katson Books. • Mc Quarrie, D. A. & Simon, J. D., Molecular Thermodynamics, 1st Edition, (2004), Viva Books.



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. Chemistry (Hons) / (Hons with Research) (Chemistry)		
Year	2026		Version	1.0		
Semester	VIII		Effective From	June, 2026		
Course Code	BSCH11808	Course Name	Major: Physical Chemistry - III (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
1	-	-	2	10	15	25

Purpose of Course	To give hands on training to students for determination of various parameters of Chemical Kinetics and Thermodynamics/Thermochemistry.
Course Objective	To give hands on training to students for various chemistry laboratory experiments related to rate constant, order of reaction, conc. of acids, various reactions, heat of neutralization, heat of solutions, etc.
Prerequisite	• Familiarity with laboratory glassware and instruments. • Preparation of standard solutions. • Basic calculations (molarity, logarithms, graph plotting). • Observation, data recording, and report writing.
Course Out come	Students will be able to learn: • To determine rate-constant(K), order of reaction and rate-constant(K) • Relative strength of HCl and H₂SO₄ • To investigate the reaction of saponification • To find out the heat of neutralization, to determine the heat of solution. etc.
Course Content	-
Practical	Any three 1. Determination of the rate-constant(K) for the hydrolysis of methyl acetate catalyzed by HCl. 2. Determination of the order of reaction and rate-constant(K) for the hydrolysis of ester (ethyl acetate) by alkali (NaOH). 3. Determination of the relative strength of HCl and H₂SO₄ by studying the hydrolysis of an ester. 4. To investigate the reaction of saponification of ethyl acetate by NaOH. 5. To find out the heat of neutralization of NaOH and HCl.



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	6. To determine the Heat of solution of organic acid (benzoic acid/ phthalic acid) by finding the solubility of the acid at two different temperature.
Reference Books	• J.B. Yadav, Advanced Physical Chemistry; 14th Edition, 1995, Goel Publishing House. • S.K.Bhasin, Sudha Rani, Laboratory Manual on Engineering Chemistry; 3rd Edition, 2011, Dhanpatrai Publishing Company. • Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H.Freeman & Co.: New York (2003). • V.K. Ahluwalia, Sunita Dhingra, Adarsh Gulati, College Practical Chemistry; 1st Edition (2005), Reprint (2013), University Press India Pvt. Ltd.



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Faculty	Science		Program	B.Sc(Hons.) / (Hons. with Research) All		
Course Type	Minor		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSMB12801	Course Name	Bioprocess Engineering-II (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CA)	Term end examinations (TEE)	Total
3	3 hrs	0	0 hrs	50	50	100

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc(Hons.) / (Hons. with Research) All		
Course Type	Minor		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSMB12802	Course Name	Bioprocess Engineering-II (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CA)	Term end examinations (TEE)	Total
1	0 hrs	0	2 hrs	50	50	100



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Name of faculty: Science	Department: Microbiology
Program: B. Sc. (Hons.) Sem-8	Type: Minor (IFT)
Subject: Bioprocess Engineering-II	
Credit: 04	Total learning hours: 45 hr
Course description: This course provides a comprehensive concept of transport phenomena within bioreactors, focusing on mixing mechanics, heat transfer dynamics, and mass transfer. Special emphasis is placed on quantifying oxygen uptake rates and measuring volumetric mass transfer coefficients which is essential for fermenter scale-up. The curriculum bridges fundamental engineering with commercial biotechnology by study of production processes for high-value metabolites.	
Student Learning outcomes: (SLOs) After completion of this course, students will be able to; - Analyse fluid flow patterns, and impeller types for stirred-tank bioreactors. - Apply the principles of heat transfer to control the temperature in fermenter. - Evaluate and measure mass transfer and Oxygen transfer. - Formulate operational strategies for the large-scale industrial cultivation of microbial biomass, commercial vitamins, and industrial enzymes.	

References:

- Crueger, W., & Crueger, A. (1990). *Biotechnology: A textbook of industrial microbiology*. Sinauer Associates. ISBN: 978-0-87893-131-6
- Doran, P. M. (1995). *Bioprocess engineering principles*. Academic Press. ISBN: 978-0-12-220851-5
- Waites, M. J., Morgan, N. L., Rockey, J. S., & Higton, G. (Eds.). (2002). *Industrial microbiology: An introduction*. Blackwell Science. ISBN: 978-0-632-05307-0
- Welty, J., Rorrer, G. L., & Foster, D. G. (2008). *Fundamentals of momentum, heat, and mass transfer* (5th ed.). John Wiley & Sons. ISBN: 978-0-470-12868-8

Further Reading

- Baltz, R. H., Demain, A. L., & Davies, J. E. (Eds.). (2010). *Manual of industrial microbiology and biotechnology*. American Society for Microbiology Press. ISBN: 978-1-55581-512-7
- Mohanty, K., & Sasmal, S. (2025). *Biochemical reaction engineering*. CRC Press. ISBN: 978-1-003-58111-6
- Okafor, N., & Okeke, B. C. (2017). *Modern industrial microbiology and biotechnology*. Science Publishers. ISBN: 978-1-57808-513-2

Unit: 1: Mixing

(07 Hrs.)

- 1.1. Function of Mixing
- 1.2. Mixing equipment
- 1.3. Flow Patterns in Stirred Tank
- 1.4. Impellers
- 1.5. Mechanisms of Mixing



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1.6. Assessment of Mixing Effectiveness

Unit: 2: Heat Transfer (07 Hrs.)

- 2.1 Concept of heat transfer
- 2.2 Heat transfer equipment
- 2.3 Mechanisms of Heat transfer
- 2.4 Heat Conduction
- 2.5 Heat transfer between fluids

Unit: 3: Mass Transfer (07 Hrs.)

- 3.1 Concept of Mass transfer
- 3.2 Molecular diffusion
- 3.3 Analogy between Mass, Heat, and Momentum Transfer
- 3.4 Role of Molecular diffusion in bioprocessing
- 3.5 Film theory
- 3.6 Convective mass transfer
- 3.7 Mass Transfer Equipment

Unit: 4: Oxygen Transfer in fermenter (08 Hrs.)

- 4.1 Oxygen uptake in cell culture
 - 4.1.1 Factors Affecting Cellular Oxygen Demand
 - 4.1.2 Mass Oxygen transfer from Gas Bubble to Cell in fermenter
- 4.2 Factors Affecting Oxygen Transfer in Fermenter
- 4.3 Measuring DO Concentration
- 4.4 Measurement of $K_L a$
 - 4.4.1 Oxygen Balance Method
 - 4.4.2 Dynamic Method
 - 4.4.3 Sulphite Oxidation
- 4.5 Measurement of Oxygen Uptake Rate

Unit: 5: Bioproduction of Commercially Important Products: I (08 Hrs.)

- 5.1 Production strain and Production Process of amino acids
 - 5.1.1 L-Glutamate
 - 5.1.2 L-Lysine
 - 5.1.3 L-Threonine
- 5.2 Production strain and Production Process of amino acids
 - 5.2.1 Penicillin
 - 5.2.2 Cephalosporins
- 5.3 Microbial Production of Natural Food Preservatives

Unit: 6: Bioproduction of Commercially Important Products: II (08 Hrs.)

- 6.1 Microbial Production of Vitamins
 - 6.1.1 Vitamin B12
 - 6.1.2 Riboflavin
- 6.2 Microbial Production of Enzymes
 - 6.2.1 Amylase



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6.2.2 Proteases

6.3 Microbial Biomass Production

6.3.1 Baker's Yeast

6.3.2 Single Cell Protein (SCP)

List of Practical

1. Determination of kLa
2. Microbial Production of Amylase
3. Microbiological assay of amino acid / vitamin / antibiotic.



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc(Hons.) / (Hons. with Research) All		
Course Type	Minor		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSMB12803	Course Name	Clinical Laboratory Management (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CA)	Term end examinations (TEE)	Total
3	3 hrs	0	0 hrs	50	50	100

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc(Hons.) / (Hons. with Research) All		
Course Type	Minor		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSMB12804	Course Name	Clinical Laboratory Management (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CA)	Term end examinations (TEE)	Total
1	0 hrs	0	2 hrs	50	50	100



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Name of faculty: Science	Department: Microbiology
Program: B. Sc. (Hons.) Sem-8	Type: Minor (MLT)
Subject: Clinical Laboratory Management	
Credit: 4	Total learning hours: 45
Course description: The main objective of this paper is to build the capacity of lab managers to enable them to manage their lab services efficiently and effectively using fundamentals of management. Also included topics like total quality management, GLP & Accreditation to enhance the knowledge in this field.	
Student learning outcome: • The students will understand various lab operations, costing, investment analysis and these will equip them with better decision-making skills in delivering good quality services. • Also know basics of service quality, efficiencies and professionalism in lab management • Understand standards of laboratory practice.	

Reference Book:

- P.B. Godkar, (2014), Textbook of Medical Laboratory Technology, 3rd ed., Bhalani Publishing House, Mumbai, India. (ISBN: 9789381496190)
- Cheesbrough Monica ,District laboratory practice in tropical countries VOL-1 & 2, Cambridge University Press.(ISBN: 9780521665476)
- Shubhangi Tambwekar (2009), Handbook of Quality Assurance in Laboratory Medicine, BI Pub. (ISBN: 9788172253158)
- WHO (2011): Laboratory quality management system: handbook (ISBN: 978924 1548274) .
- Endris Mekonnen (2004), Health Laboratory Management and Quality Assurance, Ethiopia Public Health Training Initiative (EPHTI).
- Ochei J. & Kolhatkar A. (2000), *Medical Laboratory Science: Theory & Practice*, Tata McGraw Hill Pub. (ISBN: 9780074632239)

Unit-1: Introduction to Clinical Laboratory Management and Organization. (07 Hrs)

- 1.1 Definition and General Principles
- 1.2 Concepts and function of Management
- 1.3 Laboratory Structure
- 1.4 Role of Laboratory in Health Care and Training of Laboratory Personnel
- 1.5 Code of Conduct

Unit-2: Laboratory Biosafety and waste management (07 Hrs)

- 2.1 Source of Laboratory Hazards
- 2.2 Code of safe Laboratory Practice
- 2.3 Safe Laboratory premise & personal safety measures



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- 2.4 Biosafety levels & Biosafety cabinet
- 2.5 Bio medical waste management

Unit-3: Human Resource & Financial Management (07 Hrs)

- 3.1 Human Resource Management: Staff training, competency assessment and continuing medical education (CME).
- 3.2 Selection of tests & interpretation of test results
- 3.3 Financial Planning
- 3.4 Selection, procurement & care of equipment

Unit-4: Documents, Records & Information Management (07 Hrs)

- 4.1 Introduction to documents and records
- 4.2 Quality Manual
- 4.3 Storage and control of documents and records
- 4.4 Elements of information management
- 4.5 Manual & Computerized laboratory information systems

Unit-5: Quality Management Systems (QMS) (10 Hrs)

- 5.1 Introduction to QMS: Fundamentals of Quality Assurance (QA), Quality Control (QC), and Total Quality Management (TQM)
- 5.2 Analytical Variables: Accuracy and Precision; Standard and Control; Sensitivity and Specificity; Types of Error; Standard Deviation, Co-Efficient of Variation
- 5.3 Internal and External Quality Control
- 5.4 Preparation of Quality Control Charts: Levy-Jenning Chart and Gaussian Curve; Cusum Chart
- 5.5 Westgard Multirule Charts

Unit-6: Good Laboratory Practices (GLP) & Accreditation Process (07 Hrs)

- 6.1 Introduction to Basics of GLP
- 6.2 Standard Operating Procedures (SOPs)
- 6.3 Criteria, process & advantages of Accreditation
- 6.4 Audit- Internal & External
- 6.5 Accreditation & Standards: Study of national and international standards (e.g., NABL, ISO 15189, CAP, CLIA).

List of Practical

- 1. Preparation of Levy-Jenning Chart
- 2. Use of Westgard rules for internal quality control
- 3. Formulation of SOP of any one routine laboratory procedure



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Faculty	Science		Program	B.Sc(Hons.) / (Hons. with Research) All		
Year	2026		Version	1.0		
Semester	VIII		Effective From	June, 2026		
Course Code	BSCH12801	Course Name	Minor: Modern Instrumentation for Analysis (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
3	3	-	-	40	35	75

Purpose of Course	This course paper proposes to teach about Principle, Instrumentation and Applications of various spectroscopy and chromatographic techniques and advanced instrumentation techniques.
Course Objective	To teach the students about UV-VIS, AA, ICP-OE and Mossbauer Spectroscopy, NDIR, Elemental Analyzer, TOC, GC, HPLC and IEC Instrumentation Techniques.
Pre-requisite	12 th Science Pass/ B.Sc. Chemistry Pass
Course Out come	At the end of the course students will be able to... Learn about the History, origin, laws, principles, theories, instrumental set up, its' working mechanism, various components and it's working pattern, procedure of analysis and applications in the various field of analysis about: • UV-Visible Spectroscopy • Atomic Absorption Spectrometry • Optical Emission Spectrometry • Advanced Instrumentation Techniques • Gas Chromatography • High Performance Liquid Chromatography • Ion Exchange and Ion Exclusion Chromatography



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Course Content	Unit-1: UV-Visible Spectroscopy (11 Hrs) 1.1 Characteristics of electromagnetic spectrum 1.2 Origin of spectra and electronics transitions 1.3 Classification of electronic transition 1.4 The chromophore concepts 1.5 Absorption and intensity shifts 1.6 Laws of absorption of radiation - Lambert & Beer's law and its deviation 1.7 The Instrumentation of a spectrophotometer 1.8 Calibration curve and standard addition method - multi component analysis 1.9 Applications of UV-Visible (electronic) spectroscopy
	Unit-2: Atomic Absorption Spectrometry (08 Hrs) 2.1 The history & principle of atomic absorption spectroscopy 2.2 AAS – Instrumentation 2.2.1 Radiation sources: line & continuum 2.2.2 Atomization techniques: FAAS & GFAAS 2.2.3 Wavelength selector: monochromator 2.2.4 Detectors: PMT 2.2.5 Single & double beam AAS 2.5 Applications of atomic absorption spectrometry
	Unit-3: Optical Emission Spectrometry (07 Hrs) 3.1 Introduction and principle 3.2 Atomic spectroscopic sources 3.3 Inductively coupled plasma - the discharge 3.4 ICP-OES Instrumentation 3.4.1 Nebulizers 3.4.2 Spray Chambers 3.4.3 Sample introduction systems 3.4.4 Optics and the spectrometer Emission detectors 3.5 Applications of ICP-OES
	Unit-4: Modern Instrumentation Techniques (05 Hrs) 4.1 Principle, Instrumental set up & Applications of 4.2 Non dispersive IR (gas analyzer) 4.3 Modern elemental analyzer 4.4 Total organic carbon analyzer 4.5 Mossbauer Spectroscopy
	Unit-5: Gas Chromatography (08 Hrs) 5.1 Introduction of chromatography and principle of separation 5.2 Classification -GSC and GLC & its applications 5.3 Components of instruments: carrier gas, sample injection system,



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	stationary and mobile phase 5.4 Columns - packed column and capillary column - WCOT, SCOT, PLOT 5.5 Detectors - FID, TCD, ECD, ASD 5.6 Principle and applications of GC-MS, GC-MS Unit-6: High Performance Liquid Chromatography (06 Hrs) 6.1 Introduction, principle and types of HPLC 6.2 Components of instruments: pumps 6.3 Sample injection system 6.4 Column 6.5 Detector: ultra violet light absorption, refractive index, evaporative light scattering 6.6 Selective applications in separation and estimations 6.7 Principle and applications of LC-MS
Practical	-
Reference Books	• Engineering Chemistry, P.C. Jain & Monica Jain, 17th Edition, Reprint 2011, Dhanpatrai Publishing Company (P) Ltd. • Handbook of Analytical Instrument, R.S. Khandpur, 2nd Edition, Reprint 2009, Tata McGraw Hill Publishers. • Instrumental Methods of Chemical Analysis (Analytical Chemistry), H. Kaur, 8th Edition, 2012, Pragati Prakashan. • Basic Concepts of Analytical Chemistry, S.M. Khopkar, 3rd Edition, Reprint 2009, New Age International (P) Limited, Publishers. • Analytical Instrumentation Handbook, Ewing's, Edited by Jack Cazes, 3rd Edition, 2005, Marcel Dekker Publisher. • Instrumental Methods of Analysis, H. H. Willard, L. L. Meritt, J.A. Dean and F.A. Settle, 7th Edition, 1986, CBS Publishers. • Instrumental methods of analysis, B.K. Sharma, 24th Edition, 2005, Goel Publishing House. • Instrumental Analysis, D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, 11th Edition, Reprint 2012, Cengage Learning. • 9. BIOS-Instant Notes-Analytical Chemistry, D. Kealey, P.J. Haines, 2002, Viva Books (P) Ltd. • 10. Analytical Instrumentation, Bela G. Liptak, 1st Edition, 1994, 1st Indian Reprint, 2012, Chilton Book Company. • 11. Theory and Practicals of Engineering Chemistry, Shashi Chawla, 5th Edition, 2008, Dhanpat Rai & Co. Pvt. Ltd.

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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc(Hons.) / (Hons. with Research) All		
Year	2026		Version	1.0		
Semester	VIII		Effective From	June, 2026		
Course Code	BSCH12802	Course Name	Minor: Modern Instrumentation for Analysis (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
1	-	-	2	10	15	25

Purpose of Course	To provide hands on training to students for laboratory experiments in Chemistry and Modern Instrumentation.
Course Objective	To do different analysis by using Modern Instrumentation Techniques.
Prerequisite	12 th Science Pass/ B.Sc. Chemistry Pass
Course Out come	At the end of this course the students will be able to do Chemical Analysis by using UV-Vis Double Beam spectrophotometer of various parameters and hands on training of AAS, ICP-OES, NDIR, Elemental Analyzer, TOC, GC, HPLC and IEC. etc.
Course Content	-
Practical	Any three 1. Determination of Phenol in water sample by Spectrophotometer. 2. Determination of Silica in water sample by Spectrophotometer. 3. Determination of Ni^{+2} in water sample by Spectrophotometer. 4. Determination of F^{-1} in water sample by Spectrophotometer. 5. To determine NO_3^{-1} of water sample. 6. Determination of NH_3 in water sample by Spectrophotometer.



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Sem-VII and VIII

Reference Books	• Standard Methods for Examination of Water & Wastewater, Andrew D. Eaton, Lenore S. Clesceri, Eugene W. Rice, Arnold Greenberg, 23rd Edition, 2017, published by APHA, AWWA, WEF. • Official Methods of Analysis, Dr. William Harwitz, Dr. George W Latimer, 18th Edition, 2005, published by Association of Officiating Analytical Chemists (AOAC). • Analytical Techniques in Agriculture, Biotechnology and Environmental Engineerin; A. Nag; 1st Edition, 2006, Prentice Hall of India. • Analytical Chemistry, H. Kaur, 1st Edition, 2013, Pragati Prakashan.
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SARVAJANIK UNIVERSITY**FACULTY OF SCIENCE****B.Sc (Honours) (Chemistry) / B.Sc (Honours with Research) (Chemistry)****Sem-VII and VIII**

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc(Hons.) / (Hons. with Research) All		
Course Type	Minor		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSES12801	Course Name	Forest and Wildlife Management (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CA)	Term end examinations (TEE)	Total
3	3 hrs	0	0 hrs	50	50	100

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc(Hons.) / (Hons. with Research) All		
Course Type	Minor		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSES12802	Course Name	Forest and Wildlife Management (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CA)	Term end examinations (TEE)	Total
1	0 hrs	0	2 hrs	50	50	100



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Sem-VII and VIII

Subject code: Minor	Department: Environmental Science
Program: B. Sc.	Type of Subject: Theory
Subject: Forest and Wildlife Management	
Semester-8	
Course Description: The course is designed to: 1. Develop an understanding of forest ecosystems, biodiversity, and wildlife resources. 2. Introduce scientific principles and practices of sustainable forest and wildlife management. 3. Familiarize students with forest policies, legislation, protected area management, and community participation. 4. Explain the role of forests and wildlife in climate change mitigation, ecosystem services, and sustainable development. 5. Develop knowledge of wildlife conservation techniques, habitat restoration, and human–wildlife conflict management. 6. Promote practical skills in forest inventory, biodiversity assessment, and conservation planning using modern technologies.	
Student Learning Outcomes (SLOs): At the end of the course, students will be able to: 1. Explain the structure, composition, and ecological significance of forest ecosystems. 2. Apply principles of sustainable forest and wildlife management. 3. Assess biodiversity, forest health, and wildlife habitats using scientific methods. 4. Interpret forest policies, wildlife laws, and conservation strategies. 5. Evaluate the impacts of climate change, deforestation, and habitat fragmentation. 6. Design management strategies for conservation of forests and wildlife using geospatial and digital technologies.	

Reference:

1. Khanna, L. S. *Principles and Practice of Silviculture*. Khanna Bandhu.
2. Manikandan, K. & Prabhu, S. *Indian Forestry*. Jain Brothers.
3. Negi, S. S. *Forest Management in India*. International Book Distributors.
4. Wildlife Institute of India. *Wildlife Management Training Manuals*.
5. ICAR. *Handbook of Agriculture*.
6. FAO. *Sustainable Forest Management Toolbox*.
7. Ministry of Environment, Forest and Climate Change (MoEFCC). *National Forest Policy, Wildlife Action Plan and Forest Conservation Guidelines*.



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Sem-VII and VIII

Unit 1: Introduction to Forests and Wildlife (7 Hours)

- 1.1 Forest ecosystem: concept, structure, functions and ecosystem services
- 1.2 Forest types of India and Gujarat; forest resources and biodiversity
- 1.3 Wildlife diversity, ecological importance and trophic interactions
- 1.4 Role of forests in climate regulation, carbon sequestration and Sustainable Development Goals (SDGs)

Unit 2: Forest Management Principles (8 Hours)

- 2.1 Concept, objectives and principles of sustainable forest management
- 2.2 Silvicultural systems, natural regeneration and artificial regeneration
- 2.3 Forest inventory, mensuration and forest resource assessment
- 2.4 Social forestry, agroforestry, joint forest management (JFM) and community participation

Unit 3: Wildlife Ecology and Conservation (7 Hours)

- 3.1 Wildlife ecology, habitat requirements and population dynamics
- 3.2 Protected area network: National Parks, Wildlife Sanctuaries, Biosphere Reserves and Conservation Reserves
- 3.3 Wildlife census and monitoring techniques
- 3.4 Endangered species conservation, captive breeding and species recovery programmes

Unit 4: Forest and Wildlife Protection (8 Hours)

- 4.1 Threats to forests and wildlife: deforestation, habitat degradation, invasive species and forest fires
- 4.2 Human-wildlife conflict: causes, impacts and mitigation measures
- 4.3 Forest health management, pest and disease control
- 4.4 Forest restoration, ecological restoration and landscape management

Unit 5: Forest Policy, Legislation and Governance (7 Hours)

- 5.1 National Forest Policy (1988 and recent developments), National Wildlife Action Plan
- 5.2 Indian Forest Act, 1927; Forest (Conservation) Act, 1980; Wildlife (Protection) Act, 1972; Biological Diversity Act, 2002
- 5.3 Forest Rights Act, 2006 and participatory forest governance
- 5.4 Role of Forest Department, National Biodiversity Authority, State Biodiversity Boards and local communities

Unit 6: Emerging Trends in Forest and Wildlife Management (8 Hours)

- 6.1 Climate change adaptation and mitigation in forestry
- 6.2 Remote sensing, GIS, GPS, drones and digital technologies in forest and wildlife management
- 6.3 Carbon forestry, REDD+, ecosystem restoration and nature-based solutions
- 6.4 Ecotourism, sustainable livelihood, non-timber forest products (NTFPs) and green entrepreneurship

Practicals

1. Measurement of tree density, frequency, abundance, basal area and Importance Value Index (IVI) using quadrat or transect methods.
2. Identification of common forest flora and fauna and preparation of a biodiversity inventory.
3. Identification of common wildlife species and indirect evidences (pugmarks, hoof marks, feathers, nests, pellets and scats) using museum specimens and photographs.
4. Preparation and analysis of wildlife census data using quadrat and line transect methods (calculation of density, abundance and population estimates from sample datasets).
5. Identification of wildlife diseases and parasites using preserved specimens, photographs and microscopic slides.



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Sem-VII and VIII

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program		B.Sc. (Hons) (Chemistry)	
Year	2026		Version		1.0	
Semester	VIII		Effective From		June, 2026	
Course Code	BSCH15801	Course Name	SEC: Research Methodology-II (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
2	2	-	-	25	25	50

Purpose of Course	This course aims to develop advanced competencies in scientific research by emphasizing experimental planning, analytical instrumentation, scientific publishing, project management, innovation, entrepreneurship, and emerging technologies in chemical research.
Course Objective	- To strengthen research planning and experimental design skills. - To understand advanced analytical techniques and interpretation of scientific data. - To develop scientific writing and publication skills. - To familiarize students with research project management, funding, and entrepreneurship. - To understand innovation, technology transfer, and emerging interdisciplinary research.
Pre-requisite	Students should have: - Successful completion of Research Methodology-I. - Knowledge of basic statistics and laboratory practices. - Familiarity with scientific literature and referencing software.
Course Outcome	CO1: Design research projects using appropriate experimental methodologies. CO2: Interpret data generated from modern analytical instruments.



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Sem-VII and VIII

	CO3: Prepare manuscripts, project proposals, and technical reports following ethical publication practices. CO4: Apply principles of research management, innovation, and intellectual property commercialization. CO5: Evaluate recent advances and interdisciplinary applications of chemical research
Course Content	Unit-1: Advanced Research Design and Experimental Planning (08 Hrs) 1.1 Advanced research planning 1.2 Experimental design optimization 1.3 Factorial and response surface designs 1.4 Sampling strategies 1.5 Validation of analytical methods Unit-2: Advanced Analytical Techniques and Data Interpretation (08 Hrs) 2.1 Spectroscopic techniques (UV-Visible, IR, NMR) 2.2 Chromatographic techniques (GC, HPLC) 2.3 Thermal analysis (TGA, DSC) 2.4 Electron microscopy and X-ray techniques 2.5 Instrument calibration and validation Unit-3: Scientific Publication, Project Writing and Research Management (07 Hrs) 3.1 Research proposal writing 3.2 Project report preparation 3.3 Grant writing and funding agencies 3.4 Journal selection and manuscript submission 3.5 Peer-review process 3.6 Open-access publishing 3.7 Research metrics (Impact Factor, h-index, Citation Index) Unit-4: Innovation, Entrepreneurship and Emerging Research Areas (07 Hrs) 4.1 Innovation in chemical sciences 4.2 Technology transfer 4.3 Patent commercialization and licensing 4.4 Entrepreneurship and start-up ecosystem 4.5 Computational chemistry and molecular modelling 4.6 Sustainable technologies and circular economy 4.7 Future trends in chemical research



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Sem-VII and VIII

Practical	-
Reference Books	• C. R. Kothari, Research Methodology: Methods and Techniques. • Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners. • Wayne C. Booth, Gregory G. Colomb & Joseph M. Williams, The Craft of Research. • Day, R. A. & Gastel, B., How to Write and Publish a Scientific Paper. • Montgomery, D. C., Design and Analysis of Experiments. • Miller, J. N. & Miller, J. C., Statistics and Chemometrics for Analytical Chemistry. • ICH Guidelines on Good Laboratory Practices (GLP). • WIPO publications on Intellectual Property Rights. • ACS Style Guide for Scientific Writing.



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. Chemistry (Hons with Research)		
Year	2026		Version	1.0		
Semester	VIII		Effective From	June, 2026		
Course Code	BSCH18801	Course Name	Research Project-II: (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
2	2	-	-	25	25	50

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. Chemistry (Hons with Research)		
Year	2026		Version	1.0		
Semester	VIII		Effective From	June, 2026		
Course Code	BSCH18802	Course Name	Research Project-II: (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Semester end examinations (SEE)	Total
4	-	-	8	40	60	100



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Purpose of Course	This course aims to develop advanced competencies in scientific research by emphasizing experimental planning, analytical instrumentation, scientific publishing, project management, innovation, entrepreneurship, and emerging technologies in chemical research.
Course Objective	• To strengthen research planning and experimental design skills. • To understand advanced analytical techniques and interpretation of scientific data. • To develop scientific writing and publication skills. • To familiarize students with research project management, funding, and entrepreneurship. • To understand innovation, technology transfer, and emerging interdisciplinary research.
Pre-requisite	Students should have: • Successful completion of Research Methodology-I. • Knowledge of basic statistics and laboratory practices. • Familiarity with scientific literature and referencing software.
Course Outcome	CO1: Design research projects using appropriate experimental methodologies. CO2: Interpret data generated from modern analytical instruments. CO3: Prepare manuscripts, project proposals, and technical reports following ethical publication practices. CO4: Apply principles of research management, innovation, and intellectual property commercialization. CO5: Evaluate recent advances and interdisciplinary applications of chemical research
Course Content	Unit-1: Advanced Research Design and Experimental Planning (08 Hrs) 1.1 Advanced research planning 1.2 Experimental design optimization 1.3 Factorial and response surface designs 1.4 Sampling strategies 1.5 Validation of analytical methods Unit-2: Advanced Analytical Techniques and Data Interpretation (08 Hrs) 2.1 Spectroscopic techniques (UV-Visible, IR, NMR) 2.2 Chromatographic techniques (GC, HPLC) 2.3 Thermal analysis (TGA, DSC) 2.4 Electron microscopy and X-ray techniques 2.5 Instrument calibration and validation Unit-3: Scientific Publication, Project Writing and Research Management (07 Hrs) 3.1 Research proposal writing 3.2 Project report preparation 3.3 Grant writing and funding agencies 3.4 Journal selection and manuscript submission 3.5 Peer-review process 3.6 Open-access publishing 3.7 Research metrics (Impact Factor, h-index, Citation Index)



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FACULTY OF SCIENCE

B.Sc (Honours) (Chemistry) / B.Sc (Honours with Research) (Chemistry)

Sem-VII and VIII

	Unit-4: Innovation, Entrepreneurship and Emerging Research Areas (07 Hrs) 4.1 Innovation in chemical sciences 4.2 Technology transfer 4.3 Patent commercialization and licensing 4.4 Entrepreneurship and start-up ecosystem 4.5 Computational chemistry and molecular modelling 4.6 Sustainable technologies and circular economy 4.7 Future trends in chemical research
Practical	-
Reference Books	• C. R. Kothari, Research Methodology: Methods and Techniques. • Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners. • Wayne C. Booth, Gregory G. Colomb & Joseph M. Williams, The Craft of Research. • Day, R. A. & Gastel, B., How to Write and Publish a Scientific Paper. • Montgomery, D. C., Design and Analysis of Experiments. • Miller, J. N. & Miller, J. C., Statistics and Chemometrics for Analytical Chemistry. • ICH Guidelines on Good Laboratory Practices (GLP). • WIPO publications on Intellectual Property Rights. • ACS Style Guide for Scientific Writing.

