



॥ 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

Dr. R. K. Desai Marg, Athwalines,
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CURRICULUM FOR

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

B.Sc. (Hons) (Microbiology)

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

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)
(MICROBIOLOGY) Sem-7 and 8**

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

Dr. Sanjay Parekh

**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) (Microbiology) Sem-7 and 8 is with effect from the Academic year 2026-27



SARVAJANIK UNIVERSITY
FACULTY OF SCIENCE
B.Sc. (Honours) (Microbiology) / B.Sc. (Honours with Research) (Microbiology)
Sem-VII and VIII



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

DETAILED CURRICULUM

(W.E.F. 2026-27)



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Sem-VII and VIII

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	No. of Papers	Credits	No. of Papers	Credits	No. of Papers	Credits	No. of Papers		Credits	
		Theory Hours	Theory Credits	Lab Hrs	Lab Credits												
1	2	3+3	3+3	2+2	1+1	8	1	4	1	2	1	4	1	2	22		
2	2	3+3	3+3	2+2	1+1	8	1	4	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	4	1	2	22		
4	3	3+3+3	3+3+3	2+2+2	1+1+1	12	1	4	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	Internshi	4	1	2			22		
Total after 3y	16					64	6	24	5+I	10+4	5	10	3	12	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+I	18/26	5	10	3	12	4	8	176



SARVAJANIK UNIVERSITY

FACULTY OF SCIENCE

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

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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Sem-VII and VIII

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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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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B.Sc. (Honours with Research)
B.Sc. (Hons) (Microbiology) /
B.Sc. (Hons with Research) (Microbiology)

SEM - 7

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



SARVAJANIK UNIVERSITY
FACULTY OF SCIENCE
B.Sc. (Honours) (Microbiology) / B.Sc. (Honours with Research) (Microbiology)
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) Microbiology		
Course Type	Major		Version	1.0		
Semester	07		Effective From	June, 2026		
Course Code	BSMB11701	Course Name	Microbial Diversity & Systematics (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) Microbiology		
Course Type	Major		Version	1.0		
Semester	07		Effective From	June, 2026		
Course Code	BSMB11702	Course Name	Microbial Diversity & Systematics (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



SARVAJANIK UNIVERSITY**FACULTY OF SCIENCE****B.Sc. (Honours) (Microbiology) / B.Sc. (Honours with Research) (Microbiology)****Sem-VII and VIII**

Name of faculty: Science	Department: Microbiology
Program: B.Sc. (Hons.) Microbiology Sem-7	Type: Major
Subject: Microbial Diversity and Systematics	
Credit: 04	Total learning hours: 45
Course description: Microbial Diversity and Systematics is an intense learning course with the objectives to study basic concepts, principles and methods of microbial diversity and Systematics. This provides opportunity to understand the ubiquitous nature of microorganisms. It mainly highlights the ever-present microbial flora and provides basic knowledge about different group of microbes including archae, prokaryotes, eukaryotes, algae, viruses and extremophiles.	
Student learning outcome: • Students will acquire knowledge of microbial diversity including important microbes impacting health and environment. • Enhanced Understanding and distinguishing learning about various genera of microbial world After completion of the course students would be able to characterised, identify and differentiate various groups of microbes along with understanding of microbial adaptability to natural habitats	

References

1. Principles of Microbial Diversity. James W. Brown.(2015). ASM Press Washington DC.ISBN 978-1-55581-442-7 (pbk.) ISBN 978-1-55581-851-7 (e-book)
2. Microbial Diversity: Form and Function in Prokaryote. Oladele Ogunseitan (2005). Blackwell Science Ltd ISBN 0-632-04708-9 (pbk: alk.paper)
3. Extremophiles Microorganisms Thriving at the Edge of Life. Elif Özbey (2025). 1st Edtn. Sakarya University Publication. E- ISBN: 978-605-2238-84-4.
4. Extremophiles From Biology to Biotechnology. Ravi Durvasula D. V. Subba Rao. (2018). CRC Press Taylor & Francis Group. -13: 978-1-4987-7492-5
5. Extremophiles Handbook . Koki Horikoshi. Vol 1.Springer ISBN:978-4-431-53897
6. Bergeys Manual of Systematic Bacteriology. Second edition. Volume 2.Springer
7. Introduction to Modern Virology N. J. Dimmock A. J. Easton K. N. Leppard 6th Edt (2007). Blackwell Publishing. ISBN-13: 978-1-4051-3645-7 (pbk. : alk. paper) ISBN-10: 1-4051-3645-6 (pbk: alk. paper)
8. Fungi Biology and Applications. Kevin Kavanagh (2011).2nd Edtn.Wiley-Blackwell ISBN 978-0-470-97710-1 (cloth)– ISBN 978-0-470-97709-5 (pbk.)
9. Algae Anatomy, Biochemistry, and Biotechnology. Laura Barsanti Paolo Gualtier.(2006) CRC Press Taylor & Francis Group ISBN-10: 0-8493-1467-4,ISBN-13: 978-0-8493- 1467-4.



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FACULTY OF SCIENCE

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Sem-VII and VIII

10. Biodiversity Measurement and Estimation .D.L.Hawksworth (1995.)Chapman & Hall London.ISBN:041275220.
11. A text Book of Protozoa. R.L Kotpal. Zoology Phylum.(2006).Rastogi Publication.ISBN:81-7133-879-8

Further Reading:

- Brock Biology of Microorganisms. Michael T Madigan, Kelly S Bender, Daniel H Buckley, W. Matthew Sattley, David A Stahl. (2019)15th Edtn Paerson ISBN:978-0-13-426192-8
- Microbial Diversity in Ecosystem Sustainability and Biotechnological Applications. Vol. 1. Microbial Diversity in Normal & Extreme Environments. Tulasi Satyanarayana,Bhavdish Narain Johri, SubarataKumar Das (2019). Springer Nature. Singapore. ISBN:978-981-13-8314-4,ISBN:978-981-133-8315-1
- The Prokaryotes . 3rd Edtn,A Hanbook on Biology of Bacteria:Ecophysiology and Biochemistry.Vol 2. Martin Dworkin,Stanley Falkow, EugeneRosenberg, Karl-Heinz Schlefer,Erko Stakebrandt.(2006).Springer Science. ISBN:10:0-387-25492-7,E- ISBN:0-387-33491-2
- Prescotts Microbiology. Joanne M Willey,Linda M Sherwood, Christopher J Woolverton.(2017).Mc Graw Hill Education.ISBN978-1-259-28159-4

Unit 1 Principles of Microbial Diversity

(Duration: 7 Hrs)

- 1.1 Environmental evolution and the concept of microbial species
- 1.2 Microbial Diversity: Morphological, structural, metabolic, ecological, behavioural and evolutionary
- 1.3 Biodiversity at molecular level and genetic level
- 1.4 Theoretical and practical aspects of quantification of microbial diversity
- 1.5 Methods for assessing Microbial Diversity: Microscopic, Culture methods, Molecular and genomic methods, Phylogenetic analysis.
- 1.6 Phylogenetic Information and Constructing Phylogenetic tree
- 1.7 Natural antibiosis and microbial diversity, Comparative genomics and metagenomics

Unit 2 Archea and Extremophilic Bacteria

(Duration: 7Hrs)

- 2.1 General properties of the Archaea
 - 2.1.1.Phylum Crenarchaeota
 - 2.1.2.Phylum Euryarchaeota
 - 2.1.3.Phylum Korarchaeota
 - 2.1.4.Phylum Nanoarchaeota
- 2.2 Extremophiles Categories :Halophiles, Acidophiles, Alkaliphiles, Barophiles, Radiophiles
- 2.3 Evolution of Strategies of extremophiles
- 2.4 Molecular adaptation mechanism
- 2.5 Methods for isolation and study of extremophiles
- 2.6 Applications of extremophiles



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Unit 3 Bacterial Systematics

(Duration: 7 Hrs)

- 3.1 Prokaryotic domain: Classification and Nomenclature
- 3.2 Bergeys Manual: Past and current status
- 3.3 Identification of prokaryotes: Numerical and polyphasic taxonomy
- 3.4 Identification of Uncultivated organisms
- 3.5 Isolation and cultivation of prokaryotes
- 3.6 Phenotype and Phylotype
- 3.7 Culture collections: Importance and needs
- 3.8 Intellectual property of prokaryotes

Unit 4 Mycology

(Duration: 8 Hrs)

- 4.1 Morphology of Yeasts and Fungi
- 4.2 Ultrastructure and Function of Fungal Cells
- 4.3 Fungal Nutrition and Metabolism
- 4.4 Growth and Reproduction in Fungi
- 4.5 Fungal Life Cycles
- 4.6 Fungal Infections of Humans

Unit 5 Phycology

(Duration: 8 Hrs)

- 5.1 Classification, Occurrence and Distribution. of algae
- 5.2 Structure and Ultra structure of algae
- 5.3 Algal Nutrition and motility
- 5.4 Reproduction in algae
- 5.6 Algal Culturing: Collection, Storage, and Preservation.

Unit 6: Protozoology

(Duration: 8 Hrs)

- 6.1 Protista :Protozoa and Metazoa
- 6.2 Protozoa:Characteristics,locomotion and nutrition
- 6.3 Classification of protozoa
- 6.4 Reproduction in Protozoa
- 6.5 Parasitism, Protozoa and diseases

List of Practicals

1. Isolation of Halophilic bacteria
2. Isolation of cyanobacteria from soil/water
3. Examination of free living protozoa from in soil



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References

1. Patel R.J.and Patel R.K. (2015) Experimental Microbiology Vol I 9th Edt Aditya
2. Aneja K.R (2003) Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom production Technology. New Age International Publisher.
3. James G Cappuccino Chad Welsh. Microbiology. A Laboratory Manual (2018). Pearson 11th Edtn. ISBN10:1-29-17578-8.
4. Supriya Khan and Khushboo Chaudhary .Laboratory Manual of Microbiology and Soil Science. (2019). Vol.1.Delve Publishing.ISBN:978-1-77361-817-3
5. Emanuel Goldman ,Lorrence H Green.(2019). Practical Handbook of Microbiology.2nd Edtn.CRC Press Taylor& Francis Group.ISBN:13:978-0-8493-9365-5



SARVAJANIK UNIVERSITY**FACULTY OF SCIENCE****B.Sc. (Honours) (Microbiology) / B.Sc. (Honours with Research) (Microbiology)****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) Microbiology		
Course Type	Major		Version	1.0		
Semester	07		Effective From	June, 2026		
Course Code	BSMB11703	Course Name	Agriculture & Environment Microbiology (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) Microbiology		
Course Type	Major		Version	1.0		
Semester	07		Effective From	June, 2026		
Course Code	BSMB11704	Course Name	Agriculture & Environment Microbiology (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



SARVAJANIK UNIVERSITY

FACULTY OF SCIENCE

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

Sem-VII and VIII

Name of faculty: Science	Department: Microbiology
Program: B.Sc. (Hons.) Microbiology Sem-7	Type: Major
Subject: Agriculture & Environmental Microbiology	
Credit: 4	Total learning hours: 45
Course description: This course will provide complete knowledge about importance of microbial community within soil and environmental parameters. This paper will also explain Rhizosphere and Rhizoplane Microorganisms associated with it. This course gives details about Indian standards institute and Central pollution control board) standards for discharge of treated waste water (effluents). The paper gives detail explanation and use of microbes in Biodegradation, Bioremediation, Bioleaching and Biomining. It discuss the role of microorganisms in varied fields of agricultural and environmental microbiology.	
Student learning outcome: • To study the soil as a habitat for Microorganisms. • How various Factors influencing soil microbial population. • To study various Biogeochemical cycling. • How to solve agriculture and environment related problems with related applications of different microbes • Importance and use of microbes in Water Microbiology and Agricultural Microbiology. • Role of microbe in Aeromicrobiology. • To have knowledge about various methods for Wastewater treatment and Drinking water treatment.	

Reference Book:

1. Dr. R.C. Dubey and Dr. D.K. Maheshwari, A Textbook of Microbiology. S Chand Publishing. (2010). Revised Edition. ISBN 81-219-2559-2.
2. G.Rangaswami and D.J.Bagyaraj. Agriculture Microbiology 2nd Ed. Prentice Hall of India private Limited New Delhi 110001 (2009) ISBN 9788120306684.
3. James P. Lodge. Methods of air sampling and analysis, 3rd edition (2016). ISBN 0-87371-141-6.
4. Pradipta Kumar Mohapatra. Textbook of Environmental Biotechnology I.K. International Publishing House Pvt ltd. (2006) ISBN 81-88237-54-X.
5. R.C. Dubey and D.K. Maheshwari Practical Microbiology. Revised Edition. (2006). ISBN 81-219-2153-8.
6. Raina M. Maier, Ian L. Pepper and Charles P. Gerba. Environmental Microbiology, 2nd Ed. ELSEVIER:Academic press. (2009). ISBN 978-0-12-370519-8.
7. Ronald M. Atlas and Richard Bartha. Microbial Ecology: Fundamentals and Applications. 4th Ed. PEARSON. (2013) ISBN 978-81-317-1384-6.



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Further Reading:

1. Eldor A. Paul. Soil Microbiology, Ecology and Biochemistry. 3rd Ed. Academic press. (2009). ISBN 978-0-12-546807-7.
2. Eugene L. Madsen. Environmental Microbiology: From Genomes to Biogeochemistry. 2nd Ed. WILEY Blackwell. (2016). ISBN 978-1-118-43963-0.
3. Eve Riser –Roberts Remediation of Petroleum Contaminated Soils .Biological, Physical and Chemical Processes . Lewis Publihers .1998 ISBN 0-87371-858-5
4. Martin Alexander. Biodegradation and Bioremediation 2nd Edition Academic press An Imprint of Elsevier.ISBN 13:978-0-12-049861-1 ; ISBN-10:12-049861-8
5. Metcalf and Eddy Waste Water Engineering Treatment and Reuse. McGraw Hill Education (India) 4th edition (2003).ISBN 13:978-0-07-049539-5; ISBN 10:0-07- 049539-4
6. Mukesh Doble and Anil Kumar . Biotreatment of Industrial Effluents Butterworth-Heinemann An Imprint of Elsevier . (2005) ISBN 978-0-7506-7838-4
7. Robert L. Tate III. Soil Microbiology. 2nd Ed. Wiley. (2000). ISBN 0-471-31791-8.
8. Soli J Arceivala Shyam R Asolekar .WasteWater Treatment for Pollution Control and Reuse 3rd edition Mc Graw Hill Education India Pvt Ltd (2007).ISBN (13):978-0-07- 0620995
9. T.M.Schmidt and M.Schaechter .Topics in Ecology and Environmental Microbiology Edited by Academic Press (2012).ISBN;978-0-12-383878-0
10. Volodymyr Ivanov. Environmental Microbiology for Engineers. CRC Press. (2010) ISBN 978-1-4200-9234-9.

Unit-1: Microorganisms in Soil.

(Duration: 07 Hrs)

- 1.1 Soil as a habitat for Microorganisms.
- 1.2 Factors influencing soil microbial population
- 1.3 Decomposition of organic matter in soil
- 1.4 Biogeochemical cycling.
 - 1.4.1 Carbon cycle.
 - 1.4.2 Nitrogen cycle.
 - 1.4.3. Sulphur cycle.
 - 1.4.4 Phosphorus cycle.
- 1.5 Rhizosphere and Rhizoplane Microorganisms.

Unit-2: Agricultural Microbiology.

(Duration: 07 Hrs)

- 2.1 Biofertilizers
- 2.2 Biopesticides
- 2.3 Microbiology of Lignocellulose degradation in the rumen.

Unit-3: Water Microbiology.

(Duration: 07 Hrs)

- 3.1 Types of Water
- 3.2 Water Microorganisms
- 3.3 Microbiological Analysis of water



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3.4 Purification of water.

3.5 ISI (Indian standards institute) specification for drinking water.

3.6 CPCB (Central pollution control board) standards for discharge of treated waste water (effluents).

Unit-4: Wastewater treatment and Drinking water treatment.

(Duration: 08 Hrs)

4.1 Modern Wastewater treatment.

4.2 Septic Tanks.

4.3 Land application of Wastewater.

4.3 Sludge processing.

4.4 Water treatment processes.

4.5 Water treatment requirements.

4.6 Water distribution systems.

4.7 Organic carbon and microbial growth in distribution systems.

Unit-5: Microbiology of Air.

(Duration: 08 Hrs)

5.1 Significance of Air.

5.2 Vedic Technology for air purification.

5.3 Works on Aeromicrobiology in India.

5.4 Indoor Aeromicrobiology.

5.5 Aeroallergens and Aeroallergy.

5.6 Phylloplane Microflora.

5.7 Sampling Aerosols by filtration.

Unit-6: Biodegradation, Bioremediation, Bioleaching and Biomining. (Duration: 08 Hrs)

6.1 Principles of bacterial degradation.

6.2 Aerobic bacterial degradation of Biopolymer.

6.3 Anaerobic bacterial degradation of Biopolymer.

6.4 Approaches to Bioremediation.

6.5 Bioremediation of contaminated soils and aquifers.

6.6 Bioremediation of marine oil pollutants.

6.7 Bioremediation of air pollutants.

6.8 Bioleaching of copper, gold, uranium and phosphate.

List of Practical

1. Determination of Biochemical oxygen demand (BOD) and Chemical oxygen demand (COD) of water.
2. Determination of Total Suspended Solids (TSS) and Total Dissolved Solids (TDS).
3. Determination of total acidity & alkalinity of water.
4. Determination of chlorine demand in water.
5. Isolation of Fecal indicator bacteria by membrane filter technique from Sewage.



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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) Microbiology		
Course Type	Major		Version	1.0		
Semester	07		Effective From	June, 2026		
Course Code	BSMB11705	Course Name	Advances in virology (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) Microbiology		
Course Type	Major		Version	1.0		
Semester	07		Effective From	June, 2026		
Course Code	BSMB11706	Course Name	Advances in virology (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: Sciences	Department: Microbiology
Program: B.Sc. (Hons.) Microbiology Sem-7	Type: Major
Subject: Advances in Virology	
Credit: 4	Duration: 45 hours
Course description: This course gives advance knowledge about molecular structure and classification of viruses. This course also describe how viral infections are emerging and their association with cancer.	
Learning Outcomes: Upon successful completion of this course, students will be able to: • Describe the structure & replication strategy of viruses. • Understand re-emerging viral infections. • Acquire knowledge about association of virus and cancer. Develop understanding on viral disease surveillance.	

Reference:

1. Basic virology. 3rd Edition, Blackwell publishers, Wagner, Hewlett, Bloom & Camerini, 2008. ISBN-13:978-1-4051-4715-6.
2. Principals of molecular virology, 4th Edition. Alan. J. Cann, Elsevier academic press, 2005. ISBN: 0-12-088787-8.
3. Fields virology, 5th Edition Vol. 1 David. M. Knipe, Peter M. Howley, 2007, LWW, ISBN-13: 978-0-7817-6060-7.
4. Shors, T., (2013), Understanding viruses, 2nd edition, Jones and Bartlett, ISBN: 978-1-4496-4892-3
5. David Buckeridge, Genevieve Cadieux (2007) Emerging Viruses in Human Populations. DOI 10.1016/S0168-7069(06)16013-9.
6. John Carter and Venetia A. Saunders (2007) Virology: Principles and Applications. John Wiley & Sons.
7. N. J. Dimmock, A. J. Easton and Keith Leppard(2007) Introduction to Modern Virology, 6th Blackwell Pub.Edition.ISBN: 978-1405136457
8. Wagner (2009) Basic Virology Wiley-Blackwell ISBN: 978-1405147156

Unit 1: Molecular architecture of viruses**(6 Hours)**

- 1.1 Virus Particles are constructed from subunits.
 - 1.2 The structure of filamentous viruses and nucleoproteins
 - 1.3 The structure of isometric virus particles
 - 1.4 Enveloped virus particles
- 1.5 Virus particles with head-tail morphology



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Unit 2: Viral Genome

(10 Hours)

- 2.1 Structure and complexity of viral genome
- 2.2 DNA genomes- Linear and Circular, Double and Single stranded.
- 2.3 RNA genomes- Positive and Negative, Linear, Circular, Double and Single stranded,
- 2.4 Segmented and multipartite virus genomes.

Unit 3: Replication of viruses

(7 Hours)

- 3.1 Outline of the virus replication cycle.
- 3.2 Investigation of virus replication (Cann Pg. No, 104-108)
- 3.3 Viral Entry
 - 3.3.1 Animal virus entry in to cells – The role of cellular receptor
 - 3.3.2 Mechanisms of entry of nonenveloped and enveloped viruses
 - 3.3.3 Entry of virus in to plant cells
 - 3.3.4 Injection of phage DNA in to E. coli
 - 3.3.5 Nonspecific methods of introducing viral genomes into cells
- 3.4 Latent Events in viral infection: Capsid assembly and viron release

Unit 4: Emerging and Re-emerging virus diseases

(10 Hours)

- 4.1 Introduction to emerging viruses
- 4.2 Viruses in new host species
- 4.3 Viruses in New Areas
- 4.4 Viruses in new host species and new areas
- 4.5 New Viruses
- 4.6 Re-Emerging Viruses

Unit 5: Viruses and Cancer

(6 Hours)

- 5.1 Immortalization, transformation and tumorigenesis
- 5.2 Oncogenic viruses
- 5.3 Papillomavirus-Linked Cancer
- 5.4 Polyomavirus-Linked Cancer
- 5.5 Epstein-Barr virus-Linked cancer
- 5.6 Kaposi's Sarcoma
- 5.7 Hepatitis virus and liver cancer
- 5.8 Virus associated cancer in Animals
- 5.9 How do viruses cause cancer?
- 5.10 Prevention of virus-induced cancer



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Unit 6: Virus disease surveillance

(6 Hours)

- 6.1 Goals of surveillance
- 6.2 Surveillance settings and mandates
- 6.3 Types of surveillance

List of Practical

- 1) Isolation of coliphage from sewage.
- 2) Study one-step growth curve.



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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) Microbiology		
Course Type	Major		Version	1.0		
Semester	07		Effective From	June, 2026		
Course Code	BSMB11707	Course Name	Molecular Biology & Genetic Engineering (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) Microbiology		
Course Type	Major		Version	1.0		
Semester	07		Effective From	June, 2026		
Course Code	BSMB11708	Course Name	Molecular Biology & Genetic Engineering (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.) Microbiology Sem-I	Type: Major
Subject: Molecular Biology and Genetic Engineering	
Credit: 04	Total learning hours: 45 hr
Course description: This course provides a comprehensive foundation of molecular biology. Students will study the structure, function, and interactions of cellular macromolecules—specifically DNA, RNA, and proteins—and trace the flow of genetic information through replication, transcription, and translation. By understanding the fundamental principles, they will also understand the core principles of genetic engineering. This segment focuses on recombinant DNA technology, gene cloning, genomic editing tools, and the commercial expression of recombinant products.	
Student Learning outcomes: (SLOs) • After completion of this course, ○ Students will also be able to understand the concepts of central dogma of molecular biology, including DNA replication, transcription, RNA processing, and translation mechanisms. ○ Students will also be able to understand the concepts of restriction digestion, vector selection, host transformation, and selection strategies for recombinant clones. ○ They able to understand the core principle and application of various tools like PCR. ○ Ultimately, this course prepares students to understand commercial genetic engineering operations for industrial biotechnology, including biopharmaceuticals, transgenic crops, gene therapies, vaccine and recombinant enzymes.	

References:

- Allison, L. A. (2007). *Fundamental molecular biology*. Blackwell Publishing. ISBN 978-1-4051-0379-4
- Brown, T. A. (2016). *Gene cloning and DNA analysis: An introduction* (7th ed.). Wiley-Blackwell. ISBN 978-1-119-07256-0
- Glick, B. R., & Patten, C. L. (2022). *Molecular biotechnology: Principles and applications of recombinant DNA* (6th ed.). ASM Press. ISBN 978-1-683-67364-4
- Nelson, D. L., & Cox, M. M. (2005). *Lehninger principles of biochemistry* (4th ed.). W. H. Freeman. ISBN 978-0-716-74339-2
- Nicholl, D. S. T. (2023). *An introduction to genetic engineering* (4th ed.). Cambridge University Press. ISBN 978-1-109-18060-3
- Patnaik, B. K., Ghosh, S. N., & Das, H. K. (2012). *Textbook of biotechnology*. Tata McGraw Hill Education. ISBN 978-0-07-107007-2
- Rastogi, S., & Pathak, N. (2009). *Genetic engineering* (Illus. ed.). Oxford University Press. ISBN 978-0-19-569657-8



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- Russell, P. J. (2010). *iGenetics: A Molecular Approach* (3rd ed.). Benjamin Cummings. ISBN 978-0-321-58102-0
- Schleif, R. F. (1993). *Genetics and molecular biology* (2nd ed.). The Johns Hopkins University Press. ISBN 978-0-801-84674-8
- Willey, J. M., Sherwood, L. M., & Woolverton, C. J. (2017). *Prescott's microbiology* (10th ed.). McGraw-Hill Education. ISBN 978-1-259-28159-4
- Krebs, J. E., Goldstein, E. S., & Kilpatrick, S. T. (2014). *Lewin's GENES XI* (11th ed.). Jones & Bartlett Learning. ISBN 9781449659851

Unit: 1: Genome Organization

(07 hrs.)

- 1.1 The Search for Genetic Material
- 1.2 Molecular Structure of DNA and RNA, structure of A, B and Z- DNA
- 1.3 Genome Organization
 - 1.3.1 Bacterial Genome
 - 1.3.2 Eukaryotic Genome
 - 1.3.3 Organelle Genome
 - 1.3.4 Viral Genome

Unit: 2: Replication and Repair

(08 hrs.)

- 2.1 Replication of DNA
 - 2.1.1 Semiconservative nature of replication: Experimental Proofs
 - 2.1.2 Enzymes involved in Replication: DNA Polymerases, Protein Factors and other enzymes
 - 2.1.3 Replication in bacteria
 - 2.1.4 Replication in Eukaryotes
 - 2.1.5 Replication of Organelle DNA and Rolling circle mechanism in Plasmid
 - 2.1.6 Fidelity of Replication
- 2.2 Mechanisms of genetic variation
 - 2.2.1 Mutation
 - 2.2.2 Repair mechanism
- 2.3 Recombination and Horizontal Gene Transfer

Unit: 3: Gene Expression

(08 hrs.)

- 3.1 RNA
 - 3.1.1 Structure and function of various types of RNA
 - 3.1.2 Structure and function of various types of non-coding RNA
- 3.2 Synthesis of RNA
 - 3.2.1 Transcription in Prokaryotes
 - 3.2.2 Transcription in Eukaryotes
- 3.3 RNA Processing in Eukaryotes
- 3.4 Genetic Code
- 3.5 Structure of Ribosome
- 3.6 Aminoacyl t-RNA
- 3.7 Translation in Prokaryotes: Initiation, Elongation and Termination



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3.8 Post Translational Modification of Proteins

3.9 Molecular Chaperons

Unit: 4: Gene Regulation

(07 hrs.)

4.1 Regulation of Gene Expression in Bacteria

4.1.1 *Lac* Operon

4.1.2 *Trp* Operon

4.2 Regulation of Gene Expression in Eukaryotes

4.3 Regulation of Gene Expression in Phage

4.4 Regulation of Gene Expression in Archaea

Unit: 5: Core Tools for Genetic Engineering

(08 hrs.)

5.1 Basic Steps for Genetic Engineering

5.2 Enzymes used in Genetic Engineering: Restriction Endonucleases, Ligases, Polymerases, Modifying enzymes

5.3 Nucleic Acid Amplification

5.3.1 PCR

5.3.2 Variant of PCR: RT PCR and qRT PCR, multiplex PCR, nested PCR

5.4 Cloning Vectors

5.4.1 Plasmid Vectors

5.4.2 Phage Vectors: λ and M13

5.4.3 Cosmid

5.4.4 Phagemid

5.4.5 Advanced Vectors: BACs YACs, MACs

5.4.6 Expression Vectors

5.4.7 Shuttle Vectors

5.5 Cutting and Joining of DNA Fragment

5.6 Transformation of DNA in to host Cell: *E. coli*

5.7 Construction of Genomic and cDNA library

5.8 Screening of Clones

5.8.1 Screening by DNA Hybridization

5.8.2 Immunological Screening

5.8.3 Screening by Protein activity

Unit: 6: Advanced Genetic engineering and Application of rDNA Technology (07 hrs.)

6.1 Genome Editing using Engineered Nucleases

6.1.1 Zinc-Finger Nucleases

6.1.2 TALENs

6.1.3 The CRISPR-Cas9 System

6.1.4 CRISPR-Cas9

6.1.5 Prime Editing

6.2 Application of rDNA Technology

6.2.1 Production of Enzymes and recombinant bovine somatotropin

6.2.2 Production of Therapeutic Products

6.2.3 Vaccine Development



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- 6.2.4 Production of Therapeutic Antibodies
- 6.2.5 Gene therapy
- 6.2.6 RNA Interference
- 6.2.7 Genetic Fingerprinting

List of Practicals

1. Isolation of fungal genomic DNA
2. Isolation of total RNA from yeast
3. Isolation of bacterial plasmid
4. Restriction & Ligation of DNA
5. DNA amplification by PCR
6. Study of Transformation in *E. coli* / Yeast



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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	07		Effective From	June, 2026		
Course Code	BSES12701	Course Name	Agriculture 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	07		Effective From	June, 2026		
Course Code	BSSE12702	Course Name	Agriculture 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

Subject code: Minor	Department: Environmental Science
Program: B. Sc.	Type of Subject: Theory
Subject: Agriculture Management	
Semester-7	



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Course Description:

This course aims to provide a

basic understanding of principles and scope of agriculture management. It also explores different crops, their management, and economic importance.

1. Develop a comprehensive understanding of agricultural management principles and sustainable farming systems.
2. Familiarize students with planning, organization, resource utilization, and decision-making in agriculture.
3. Introduce modern agricultural technologies, precision farming, and climate-smart agriculture.
4. Enhance knowledge of agricultural marketing, value chains, agribusiness, and entrepreneurship.
5. Promote scientific management of soil, water, crops, and farm resources for sustainable development.
6. Equip students with practical skills for farm planning, record keeping, and agricultural enterprise management.

Student Learning Outcomes (SLOs):

At the end of the course, students will be able to:

Explain the principles and scope of agricultural management.

1. Prepare farm plans and efficiently manage agricultural resources.
2. Apply sustainable farming practices and precision agriculture technologies.
3. Analyze agricultural markets, supply chains, and farm economics.
4. Evaluate government policies, agricultural schemes, and risk management strategies.
5. Develop entrepreneurial skills for successful agricultural enterprises.

Reference:

1. Brady, N. C. & Weil, R. R. *The Nature and Properties of Soils*. Pearson.
2. Pandey, M. M. *Agricultural Engineering*. CBS Publishers.
3. Reddy, S. R. *Principles of Crop Production*. Kalyani Publishers.
4. Tandon, P. K. & Dhandyal, S. P. *Principles and Methods of Farm Management*. Kalyani Publishers.
5. Lekhi, R. K. & Singh, J. *Agricultural Economics*. Kalyani Publishers.
6. Palaniappan, S. P. & Sivaraman, K. *Cropping Systems in the Tropics*. New Age International.
7. Sharma, A. K. *Biofertilizers for Sustainable Agriculture*. Agrobios.
8. Singh, B. D. *Agricultural Biotechnology*. Kalyani Publishers.
9. National Institute of Agricultural Extension Management (MANAGE). *Agribusiness and Agricultural Extension Study Materials*.
10. ICAR. *Handbook of Agriculture*. Indian Council of Agricultural Research.
11. FAO. *Climate Smart Agriculture Sourcebook*.
12. Government of India. *National Mission on Sustainable Agriculture Guidelines*.

Unit 1: Introduction to Agriculture Management (7 Hours)

- 1.1 Concept, scope, objectives and importance of agriculture management
- 1.2 Indian agriculture: characteristics, challenges and opportunities
- 1.3 Types of farming systems: subsistence, commercial, mixed, organic and integrated farming
- 1.4 Role of agriculture in sustainable development and food security



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Unit 2: Farm Resource Management (8 Hours)

- 2.1 Management of land, soil, water and farm inputs
- 2.2 Cropping systems, crop planning and crop rotation
- 2.3 Farm machinery, mechanization and resource optimization
- 2.4 Farm records, budgeting, cost analysis and farm accounting

Unit 3: Sustainable Agriculture and Climate Smart Farming (7 Hours)

- 3.1 Principles of sustainable agriculture and natural resource conservation
- 3.2 Organic farming, integrated nutrient management (INM) and integrated pest management (IPM)
- 3.3 Climate-smart agriculture and adaptation strategies
- 3.4 Precision agriculture: GPS, GIS, drones, sensors and smart irrigation

Unit 4: Agricultural Economics and Agribusiness Management (8 Hours)

- 4.1 Agricultural production economics and resource allocation
- 4.2 Agricultural marketing systems and value chain management
- 4.3 Supply chain management, contract farming and Farmer Producer Organizations (FPOs)
- 4.4 Agricultural entrepreneurship, start-ups and agri-business models

Unit 5: Sustainable Agricultural Resource Management (7 Hours)

- 5.1 Soil health management: soil fertility, nutrient management and soil conservation techniques
- 5.2 Water resource management: irrigation methods, rainwater harvesting, watershed management and water-use efficiency
- 5.3 Integrated Farming Systems (IFS), integrated nutrient management (INM) and integrated pest management (IPM)
- 5.4 Climate-smart agriculture, carbon farming and sustainable agricultural practices

Unit 6: Modern Agriculture, Agribusiness and Entrepreneurship (8 Hours)

- 6.1 Precision agriculture: GPS, GIS, drones, sensors and Internet of Things (IoT) in farming
- 6.2 Post-harvest management, storage, value addition and food processing
- 6.3 Agricultural marketing, Farmer Producer Organizations (FPOs), e-NAM and agricultural supply chains
- 6.4 Agricultural entrepreneurship, Agri-tech start-ups, circular agriculture and future trends in Agriculture 4.0

Practicals:

- 1. Determination of seed germination percentage and seed vigour index.
- 2. Isolation of microorganisms commonly used as biofertilizers (Rhizobium, Azotobacter, PSB).
- 3. Determination of soil properties from agriculture soil samples (Soil pH, Electrical Conductivity (EC), Moisture content, Organic carbon (Walkley-Black method).
- 4. Detection and estimation of IAA from agricultural important plants/microorganisms.
- 5. Study of Weather and Weather forecasting.
- 6. Determination of leaf area index (LAI)
- 7. Estimation of chlorophyll content using leaf samples (chlorophyll extraction method).



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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	07		Effective From	June, 2026		
Course Code	BSMB12701	Course Name	Bioprocess Engineering-I (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	07		Effective From	June, 2026		
Course Code	BSMB12702	Course Name	Bioprocess Engineering-I (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-7	Type: Minor (IFT)
Subject: Bioprocess Engineering-I	
Credit: 04	Total learning hours: 45 hr
Course description: This course provides a comprehensive foundation in bioprocess engineering. Student will explore the concepts of thermodynamics, and basics of Engineering principles. The curriculum emphasizes practical behaviour of fluids in the bioreactor. Learners will evaluate commercial production of commercially high-value metabolites.	
Student Learning outcomes: (SLOs) • After completion of this course, students will be able to design, analyse, and optimize industrial fermentation processes. • Students will able to design thermodynamically stable fermentation process. • Students will also able to understand the concepts of Newtonian and non-Newtonian fluid rheology in fermentation broths. • Ultimately, this course prepares students to understand the commercial fermentation operations for industrial metabolites, including organic acids, biofuels and exopolysaccharides.	

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., & Highton, G. (Eds.). (2002). *Industrial microbiology: An introduction*. Blackwell Science. ISBN: 978-0-632-05307-0

Nelson, D. L., Cox, M. M., & Hoskins, A. A. (2021). *Lehninger principles of biochemistry* (8th ed.). W. H. Freeman. ISBN: 978-1319381493

Unit: 1: Fundamentals of Bioprocess Engineering

(07 Hrs.)

1.4 What is Bioprocess Engineering?

1.5 Steps in Bioprocess Development

1.6 Basic calculations in Engineering

1.6.1 Physical Variables

1.6.2 Dimensions

1.6.3 Units

1.6.4 Force and Weight

1.6.5 Measurement Conventions

1.6.6 Standard Conditions and Ideal Gases



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Sem-VII and VIII

- 1.7 Thermodynamic Preliminaries: System and Process
- 1.8 First and Second Law of thermodynamics
- 1.9 Concept of Work, Entropy, Free Energy and Enthalpy

Unit: 2: Material Balance

(08 Hrs.)

- 2.1. Steady State and Equilibrium
- 2.2. Law of Conservation of Mass
 - 2.2.1.General Mass Balance Equation
 - 2.2.2.Types of Material Balance
 - 2.2.3.Simplification of the General Mass Balance Equation
- 2.3. General Procedure for Material Balance Calculation
- 2.4. Material Balance Examples
 - 2.4.1.Continuous Filtration
 - 2.4.2. Batch Mixing
- 2.5. Material Balance with Recycle, Bypass, and Purge streams

Unit: 3: Energy Balance

(07 Hrs.)

- 3.1. Basic Concepts of Energy
- 3.2. Energy Balance Equation
 - 3.2.1. General Energy Balance Equation
 - 3.2.2. Steady-state flow process Energy Balance Equation
 - 3.2.3. Energy Balance Equation for Adiabatic process
- 3.3. Calculation of Enthalpy and Enthalpy Change Non-reactive process
- 3.4. General Procedure for Energy Balance Calculation
- 3.5. Energy Balance Examples

Unit: 4: Fluid Rheology

(08 Hrs.)

- 4.1. Classification of fluids and Fluids in motion
- 4.2. Viscosity & it's measurement
- 4.3. Momentum Transfer
- 4.4. Non-Newtonian fluids
- 4.5. Rheological properties of fermentation broths

Unit: 5: Bioproduction of Commercially Important Products-I

(07 Hrs.)

- 5.1. Bioproduction of Organic Acid
 - 5.1.1. Citric Acid
 - 5.1.2. Acetic Acid
 - 5.1.3.Lactic Acid
- 5.2. Bioproduction of industrial alcohols

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

- 6.1. Microbial Production of polysaccharides:
 - 6.1.1.Xanthan
 - 6.1.2.Dextran
 - 6.1.3.Alginate



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- 6.2. Microbial production of beverages
 - 6.2.1. Production of Beer
 - 6.2.2. Production of Wine
- 6.3. Microbial Transformation of Steroids and sterols

List of Practical

- 1. Bioproduction of Alcohol
- 2. Bioproduction of Citric Acid



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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	07		Effective From	June, 2026		
Course Code	BSBT12701	Course Name	Forensic Toxicology (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	07		Effective From	June, 2026		
Course Code	BSBT12702	Course Name	Forensic Toxicology (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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FACULTY OF SCIENCE
B.Sc. (Honours) (Microbiology) / B.Sc. (Honours with Research) (Microbiology)
Sem-VII and VIII

Forensic Toxicology

Unit 1: Introduction to toxicology (07 hours)

- 1.1 Definition and general account
- 1.2 History of toxicology
- 1.3 Forensic medicine in India
- 1.4 Disciplines of toxicology
- 1.5 Toxicants and their classification
- 1.6 Classification of toxicants based on organs

Unit 2: Medical toxicology (07 hours)

- 2.1 Maximum acceptable concentration
- 2.2 Toxic effects
- 2.3 Laws related to poisons
- 2.4 Features of poisoning in the living and dead
- 2.5 General principles of treatment of poisoning

Unit 3: Forensic aspects of some poisons-1 (07 hours)

- 3.1 Corrosive poisoning
- 3.2 Inorganic acid poisoning
- 3.3 Organic acid poisoning
- 3.4 Halogen poisoning
- 3.5 Alkalies

Unit 4: Forensic aspects of some poisons-2 (08 hours)

- 4.1 Irritant Poisons
- 4.2 Vegetable irritants
- 4.3 Non-metallic
- 4.4 Metallic
- 4.5 Animal irritants
- 4.6 Mechanical irritants

Unit 5: Forensic aspects of some poisons-3 (08 hours)

- 5.1 Neurotic poisons
- 5.2 Cerebral poisons
- 5.3 Deliriant poisons
- 5.4 Spinal poisons
- 5.5 Cardiac poisons



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Unit 6: Miscellaneous poisons and Clinical practice of Forensic toxicology (08 hours)

- 6.1 Asphyxiants
- 6.2 Food poisoning
- 6.3 Legal procedure
- 6.4 Post-mortem examination
- 6.5 Collection and Preservation of Viscera and Biological Sample in Poisoning Cases
- 6.6 Viscera management system

References:

1. Sharma, RK. *Concise textbook of forensic medicine and toxicology*. Global Education Consultants, 2011.
2. Pandey, K, Shukla JP and Trivedi, SP. *Fundamentals of toxicology*. Central, 2009.
3. Sharma, PD. *Toxicology*. Rastogi Publications, 2010.



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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) AI		
Course Type	Minor		Version	1.0		
Semester	07		Effective From	June, 2026		
Course Code	BSES12703	Course Name	Industrial Disaster and Safety Measures (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	07		Effective From	June, 2026		
Course Code	BSES12704	Course Name	Industrial Disaster and Safety Measures (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



SARVAJANIK UNIVERSITY**FACULTY OF SCIENCE****B.Sc. (Honours) (Microbiology) / B.Sc. (Honours with Research) (Microbiology)****Sem-VII and VIII**

Subject code: Minor	Department: Environmental Science
Program: B. Sc.	Type of Subject: Theory + Practical
Subject: Industrial Disaster and Safety Measures	
Semester-7	
Course Description: 1.The course is designed to develop a scientific understanding of industrial disasters, occupational and process safety, hazardous materials, emergency preparedness, and disaster-management systems. 2.It introduces students to the causes and consequences of industrial accidents involving fire, explosion, toxic releases, chemical spills, structural failures, and other technological hazards. 3.The course emphasizes hazard identification, risk assessment, preventive engineering, personal protection, emergency response, industrial hygiene, environmental monitoring, and post-disaster management. 4. It also develops awareness of Indian industrial safety legislation, institutional responsibilities, and the role of workers, industries, local authorities, and communities in reducing disaster risk.	
Student Learning Outcomes (SLOs): At the end of the course, students will be able to: 1. Explain the causes, types, characteristics, and environmental consequences of industrial disasters. 2. Identify industrial hazards associated with chemicals, machinery, fire, explosions, electricity, storage systems, and industrial processes. 3. Apply basic principles of hazard identification, risk assessment, safety auditing, and emergency planning.. 4. Explain fire prevention, chemical safety, occupational health, personal protective equipment, and industrial hygiene practices.	

References and Textbooks:

1. Environmental Hazards: Assessing risk and reducing disaster, Keith Smith, 6th Edition, 2013, Routledge, Taylor and Francis group.
2. Environmental Health, Assessing Risk and Reduction Disaster, Smith, K. 3rd Edition, 2001, Routledge.
3. Handbook of Disaster Risk Reduction & Management, Christian N Madu and Chu-Hua Kuei, 1st Edition, 2017, World Scientific.
4. World Famous Disasters, Narendra Malhotra, 1st Edition, 2004, Jain Book Depot.
Natural Disasters, R.K. Sharma and Gagandeep Sharma, 1st Edition, 2005, Jain Book Depot.
5. Environmental Pollution and Control in Chemical Process Industries, S.C. Bhatia, 2nd Edition, 3rd Reprint, 2014, Khanna Publishers.
6. Industrial Wastewater Treatment, A.D. Patwardhan. 1st Edition, 2nd Reprint, 2009, PHI Learning Private Limited.
7. Mistry K.U (2012): Fundamentals of Industrial Safety & Health – I, Siddharth Prakashan, Ahmedabad.
8. Mistry K.U (2012): Fundamentals of Industrial Safety & Health – II, Siddharth Prakashan, Ahmedabad.



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Sem-VII and VIII

Unit 1: Introduction to Industrial Disasters and Industrial Safety (08 Hours)

- 1.1 Concept and classification of industrial disasters
- 1.2 Causes of industrial disasters
- 1.3 Types of industrial disasters
- 1.4 Consequences of industrial disasters

Unit 2: Industrial Hazards and Risk Assessment (08 Hours)

- 2.1 Chemical and physical hazards
- 2.2 Hazard identification
- 2.3 Risk assessment
- 2.4 Risk-analysis techniques

Unit 3: Fire, Explosion and Chemical Safety (08 Hours)

- 3.1 Fundamentals of fire
- 3.2 Fire prevention and protection
- 3.3 Industrial explosions
- 3.4 Chemical safety

Unit 4: Occupational Health, Industrial Hygiene and Personal Safety (07 Hours)

- 4.1 Occupational health and industrial hygiene
- 4.2 Physical and biological hazards
- 4.3 Personal Protective Equipment
- 4.4 Safe work practices

Unit 5: Industrial Emergency Preparedness and Disaster Management (07 Hours)

- 5.1 Emergency preparedness
- 5.2 Emergency response
- 5.3 Disaster management cycle
- 5.4 Community and institutional preparedness

Unit 6: Industrial Safety Audit, Legislation and Case Studies (07 Hours)

- 6.1 Industrial safety audit
- 6.2 Industrial safety legislation in India
- 6.3 Major industrial disaster case studies
- 6.4 Contemporary approaches to industrial safety

Practical's:

- 1. Case studies of Bhopal Gas Tragedy (1984), Visakhapatnam LG Polymers Gas Leak (2020), Jaipur IOC Oil Depot Fire (2009).
- 2. Seminar on Kol-Dam Hydropower Project of Himachal Pradesh, India.
- 3. Measurement of Noise in various environments.



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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	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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Sem-VII and VIII

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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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	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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SAEVAJANIK UNIVERSITY**FACULTY OF SCIENCE****B.Sc. (Honours) (Microbiology) / B.Sc. (Honours with Research) (Microbiology)****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	07		Effective From	June, 2026		
Course Code	BSMB12703	Course Name	Molecular Diagnosis and Cytogenetics (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	07		Effective From	June, 2026		
Course Code	BSMB12704	Course Name	Molecular Diagnosis and Cytogenetics (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-7	Type: Minor (MLT)
Subject: Molecular Diagnosis and Cytogenetics	
Credit: 4	Total learning hours: 45
Course description: The main aim of the subject is to inform the knowledge about isolation, amplification, and analysis of nucleic acids (DNA and RNA) to identify infectious agents, genetic mutations, and oncology markers. Also focuses on the structure, function, and abnormalities of human chromosomes utilizing classical cell-culturing and high-resolution imaging technologies.	
Student learning outcome: At the end of the course, the students will get knowledge of • Basics of molecular biology • Principles, mechanics, and diagnostic limitations of nucleic acid analysis • Practical application & Quality control in PCR • Fundamental components & use of cell culture for cytogenetic studies • Basic aspects of clinical cytogenetics • Patterns of Inheritance & Autosomal Disorders • Laboratory diagnosis of inborn error of metabolism • Clinical Cytogenetic testing	

Reference Book:

- P.B. Godkar, (2014), Textbook of Medical Laboratory Technology, 3rd ed., Bhalani Publishing House, Mumbai, India. (ISBN: 9789381496190)
- Mahabal Ram (2010), Fundamentals of Cytogenetics and Genetics, PHI Pub, India. (ISBN: 9788120340336)
- Roger L.Miesfeld,(2013),APPLIED MOLECULAR GENETICS,Wiley pub. (ISBN: 9788126538355)
- Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology (2010),,7th ed.,Cambridge Uni. Press (ISBN:9780521178747)
- Susan Carson, Heather B. Miller, D. Scott Witherow, (2012),Molecular Biology Techniques A Classroom Laboratory Manual, 3rd ed. Academic Press (ISBN:9780123855442)
- Mukharjee K.L. (1999), Medical Laboratory Technology, 2nd ed., Tata MacGraw Hill. (ISBN: 9789352606818)



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Sem-VII and VIII

Unit-1: Molecular Pathology

(07 Hrs)

- 1.1 Introduction
- 1.2 Nucleic Acid Analysis
- 1.3 Blotting techniques: Southern, Northern & Western Blotting
- 1.4 Diagnostic application of DNA probes

Unit-2: Polymerase Chain Reaction (PCR) & Advanced Amplification (08 Hrs)

- 2.1 Sources of DNA for PCR
- 2.2 PCR: Components and Protocol
- 2.3 Practical applications & Quality control in PCR
- 2.4 Variations of the PCR: Nested PCR, RT PCR, Real time, Multiplex PCR
- 2.5 Gene Cloning- Methodology, Synthesis of cDNA

Unit-3: Rapid Diagnostics Technology

(08 Hrs)

- 3.1 Sequencing
- 3.2 Microarrays
- 3.3 NGS diagnostics

Unit-4: Basics of Clinical Cytogenetics

(07 Hrs)

- 4.1 Important definitions & normal chromosome structure
- 4.2 Fundamental components & use of cell culture for cytogenetic studies
- 4.3 Tissue Culture Laboratory
- 4.4 Constitutional Chromosome Patterns analysis

Unit-5: Chromosomal Abnormalities

(08 Hrs)

- 5.1 Patterns of Inheritance & Autosomal Disorders
- 5.2 Laboratory diagnosis of inborn error of metabolism
- 5.3 Clinical Cytogenetic testing (CCT)
- 5.4 Prenatal cytogenetics
- 5.5 Chromosomal Aneuploidy syndromes

Unit-6: Diagnosis of Various diseases using Molecular Techniques

(07 Hrs)

- 6.1 Hematopoietic neoplasm & Lymphomas
- 6.2 Genetic diseases & Familial cancers
- 6.3 Use of FISH technique in cancer genetics
- 6.4 Forensic identity and Parentage testing

List of Practical

- 1. Determination of Plasma HIV RNA (Viral load)
- 2. Cytogenetics- Various case studies should be carried out.



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. Microbiology (Hons.)		
Course Type	SEC		Version	1.0		
Semester	07		Effective From	June, 2026		
Course Code	BSMB15701	Course Name	Research Methodology - I			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CA)	Term end examinations (TEE)	Total
2	2 hrs	0	0 hrs	25	25	50



SARVAJANIK UNIVERSITY**FACULTY OF SCIENCE****B.Sc. (Honours) (Microbiology) / B.Sc. (Honours with Research) (Microbiology)****Sem-VII and VIII**

Name of faculty: Science	Department: Microbiology
Program: B.Sc. (Hons) Sem-7	Type: SEC-I
Subject: Research Methodology-I	
Credit: 02	Total learning hours: 30
Course description: This course introduces the fundamental concepts and principles of research methodology . It covers the research process, types of research, literature review, identification of research problems, formulation of research objectives and hypotheses, variables, measurement scales, data collection methods, and research design. The course equips students with the knowledge and skills required to plan, design, and conduct scientific research systematically, providing a strong foundation for research in life sciences and other scientific disciplines.	
Student learning outcome: Upon successful completion of this course, students will be able to: ➤ Understand the fundamental concepts, types, and process of scientific research. ➤ Formulate research problems, objectives, and testable hypotheses through literature review. ➤ Identify variables, measurement scales, and appropriate data collection methods for research. ➤ Design suitable research methodologies and experimental plans for scientific investigations. ➤ Apply the principles of research design to conduct systematic and ethical research.	

References:

- Kumar, R. (2005). *A Step-by-step Guide for Beginners*. Sage Publications. (ISBN: 9788132106487)
- Bairagi, V., & Munot, M. V. (Eds.). (2019). *Research methodology: A practical and scientific approach*. CRC Press.
- Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International. (ISBN: 978-81-224-2488-1)

Further Reading:

- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Patwardhan, B., Desai, A., Chourasai, A., Nag, S., & Bhatnagar, R. (2020). *Guidance Document Good Academic Research Practices*.
- University Grants Commission. (2021). *Academic Integrity and Research Quality*.

UNIT: 1 Introduction to Research:**(Duration: 08 Hrs)**

- 1.1 Definition of Research, Meaning and objectives
- 1.2 Types of research
- 1.3 Important Ingredients for Research
- 1.4 The research process
- 1.5 Criteria of Good Research
- 1.6 Problems Encountered by Researchers in India



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UNIT: 2 Important steps of research

(Duration: 08 Hrs)

- 2.1 Reviewing the literature
 - 2.1.1 Searching for the existing literature
 - 2.1.2 Reviewing the selected literature
- 2.2 Formulating a research problem
 - 2.2.1 The importance of formulating a research problem
 - 2.2.2 Sources of research problems
 - 2.2.3 Considerations in selecting a research problem
 - 2.2.4 Steps in formulating a research problem
 - 2.2.5 The formulation of research objectives
- 2.3 Identifying variables: What are variables? Types of variables

UNIT: 3 Constructing Hypothesis

(Duration: 07 Hrs)

- 3.1 Definition of Hypothesis
- 3.2 The function of a hypothesis
- 3.3 Testing of a hypothesis
- 3.4 Characteristics of hypothesis
- 3.5 Types of hypotheses

UNIT: 4 Research Design

(Duration: 07 Hrs)

- 4.1 Meaning of research design
- 4.2 Need for a research design
- 4.3 Important concepts relating to research design
- 4.4 Basic principles of experimental designs
- 4.5 Important experimental designs



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. Microbiology (Hons. with Research)		
Course Type	Research Project		Version	1.0		
Semester	07		Effective From	June, 2026		
Course Code	BSMB18701	Course Name	Research Project - I (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CA)	Term end examinations (TEE)	Total
2	2 hrs	0	0 hrs	50	50	100

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. Microbiology (Hons. with Research)		
Course Type	Research Project		Version	1.0		
Semester	07		Effective From	June, 2026		
Course Code	BSMB18702	Course Name	Research Project - I (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CA)	Term end examinations (TEE)	Total
4	0	0	8 hrs	50	50	100



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Sem-VII and VIII

Name of faculty: Science	Department: Microbiology
Program: B.Sc. (Hons. with Research) Sem-7	Type: SEC-I
Subject: Research Project-I (Th)	
Credit: 02	Total learning hours: 30
Course description: This course introduces the fundamental concepts and principles of research methodology . It covers the research process, types of research, literature review, identification of research problems, formulation of research objectives and hypotheses, variables, measurement scales, data collection methods, and research design. The course equips students with the knowledge and skills required to plan, design, and conduct scientific research systematically, providing a strong foundation for research in life sciences and other scientific disciplines.	
Student learning outcome: Upon successful completion of this course, students will be able to: ➤ Understand the fundamental concepts, types, and process of scientific research. ➤ Formulate research problems, objectives, and testable hypotheses through literature review. ➤ Identify variables, measurement scales, and appropriate data collection methods for research. ➤ Design suitable research methodologies and experimental plans for scientific investigations. ➤ Apply the principles of research design to conduct systematic and ethical research.	

References:

- Kumar, R. (2005). *A Step-by-step Guide for Beginners*. Sage Publications. (ISBN: 9788132106487)
- Bairagi, V., & Munot, M. V. (Eds.). (2019). *Research methodology: A practical and scientific approach*. CRC Press.
- Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International. (ISBN: 978-81-224-2488-1)

Further Reading:

- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Patwardhan, B., Desai, A., Chourasai, A., Nag, S., & Bhatnagar, R. (2020). *Guidance Document Good Academic Research Practices*.
- University Grants Commission. (2021). *Academic Integrity and Research Quality*.

UNIT: 1 Introduction to Research:

(Duration: 08 Hrs)

- 1.7 Definition of Research, Meaning and objectives
- 1.8 Types of research
- 1.9 Important Ingredients for Research
- 1.10 The research process
- 1.11 Criteria of Good Research
- 1.12 Problems Encountered by Researchers in India

UNIT: 2 Important steps of research

(Duration: 08 Hrs)

- 4.1 Reviewing the literature
 - 4.1.1 Searching for the existing literature
 - 4.1.2 Reviewing the selected literature
- 4.2 Formulating a research problem



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- 4.2.1 The importance of formulating a research problem
- 4.2.2 Sources of research problems
- 4.2.3 Considerations in selecting a research problem
- 4.2.4 Steps in formulating a research problem
- 4.2.5 The formulation of research objectives

4.3 Identifying variables: What are variables? Types of variables

UNIT: 3 Constructing Hypothesis

(Duration: 07 Hrs)

- 6.1 Definition of Hypothesis
- 6.2 The function of a hypothesis
- 6.3 Testing of a hypothesis
- 6.4 Characteristics of hypothesis
- 6.5 Types of hypotheses

UNIT: 4 Research Design

(Duration: 07 Hrs)

- 8.1 Meaning of research design
- 8.2 Need for a research design
- 8.3 Important concepts relating to research design
- 8.4 Basic principles of experimental designs
- 8.5 Important experimental designs



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SEM - 8

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



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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) Microbiology		
Course Type	Major		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSMB11801	Course Name	Pharmaceutical Microbiology(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) Microbiology		
Course Type	Major		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSMB11802	Course Name	Pharmaceutical Microbiology (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

Name of Faculty: Sciences	Department: Microbiology
Program: B.Sc. (Hons.) Microbiology Sem-8	Type: Major
Subject: Pharmaceutical Microbiology	
Credit: 4	Duration: 45 hours
Course description: This course gives insight of quality control & good manufacturing practice in pharmaceutical industries. It includes significance and importance of microbiological tests used in pharmaceutical industries. Also introduce with the fundamentals of clean room technology.	
Learning Outcomes: • Students will introduce with cGMP and international regulation • Students will acquaint with the methodologies of microbiological assay. • Students will introduce with the fundamentals of clean room technology.	

Reference:

- Sandle, T. (2015). Pharmaceutical microbiology: essentials for quality assurance and quality control. Woodhead Publishing. ISBN No. 9780081000229
- Hugo and Russells, (2007), Pharmaceutical Microbiology 8th Edi., Blackwell Publishing. ISBN No. 978-9332541306
- Walsh G., (2007), Pharmaceurcal Biotechnolog- Concepts and Applications, Wiley. (ISBN: 978-0-470-01244-4)
- Geoffrey Hanlon and Norman Hodges (2013), Essential Microbiology for Pharmacy and Pharmaceutical Science, Wiley-Blackwell. ISBN No. 9780470665329
- Current Good Manufacturing Practice (CGMP) Regulations. Retrieved from <https://www.fda.gov/drugs/pharmaceutical-quality-resources/current-good-manufacturing-practice-cgmp-regulations>
- Denyer, S. P. and Baird, R. M., (2008), Guide to microbiological control in pharmaceuticals and medical devices. 2nd Edition, CRC Press, Boca Raton, (ISBN: 9781444330632)
- Gupta, Antima. (2019). Chapter I Clean Room Technology. Retrieved from https://www.researchgate.net/publication/337561543_Chapter I Clean Room Technology

Unit 1: Quality Assurance & GMP

(6 Hours)

- a. The basics of pharmaceutical sector
- b. Role of the microbiologist
- c. Definition: Quality, Manufacture, Quality assurance (QA), Good manufacturing practice (GMP), Quality control (QC), In - process control, Validation. (Hugo & Russell)
- d. What is cGMP?
- e. Importance of cGMP
- f. Key aspects of GMP compliance & Ten rules of GMP



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- g. The role and development of pharmacopoeias
- h. Manufacture of sterile product: Design of premises & Aseptic areas

Unit 2: Risk Management and Auditing Microbiology Laboratory

(8 Hours)

- 2.1 Risk Management
 - 2.1.1 Approaches to risk management: FMEA & HACCP
 - 2.1.2 HACCP to enhance microbiological control of medicines
- 2.2 Quality management in pharmaceutical production
 - 2.2.1 Role, Origin & Purpose of ISO 9000 family of standards
 - 2.2.2 International Council for Harmonisation (ICH)
- 2.3 Auditing Microbiology Laboratory
 - 2.3.1 Quality Audits
 - 2.3.2 Auditors and the audit process
 - 2.3.3 Auditing the microbiology laboratory

Unit 3: Microbiological testing in pharmaceuticals -1

(6 Hours)

- 3.1 Bioburden determination
 - 3.1.1 What does “bioburden” means?
 - 3.1.2 Traditional counting methods
 - 3.1.3 Specified and objectionable microorganisms (Sandle 93-99)
 - 3.1.4 Automated bioburden determination
 - 3.1.5 Bioburden specifications in pharmacopoeias
- 3.2 Antibiotic susceptibility testing

Unit 4: Microbiological testing in pharmaceuticals -2

(8 Hours)

- 4.1 Endotoxin and Pyrogen testing
 - 4.1.1 Introduction
 - 4.1.2 Pyrogenicity
 - 4.1.3 Bacterial endotoxin
 - 4.1.4 Quantifying endotoxin
 - 4.1.5 The limulus amebocyte lysate (LAL) test
 - 4.1.5.1 Gel clot method
 - 4.1.5.2 Turbidometry method
 - 4.1.5.3 Chromogenic method
 - 4.1.6 The LAL test Applications and interference
- 4.2 Antimicrobial efficacy testing (preservative efficacy testing)

Unit 5: Sterilization and Sterility Assurance

(10 Hours)

- 5.1 Design of sterilization process
- 5.2 Sterility



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5.3 Sterility assurance and the sterility assurance level

5.4 Sterility testing

5.5 Parametric release

5.6 Sterile products

5.7 Factors affecting sterilization effectiveness

5.8 Biological indicators: Measuring sterilization

Unit 6: Cleanrooms and Environmental monitoring

(7 Hours)

6.1 Importance of clean room

6.2 Different types of clean room

6.3 Classification of clean room

6.4 Sources of Contamination in Clean room

6.5 Layout of Clean room

6.6 Air handling in clean room

List of Practical

1. Sterility testing of pharmaceutical products by direct inoculation & membrane filtration methods as per Indian Pharmacopoeia (IP).
2. Microbiological assay of amino acid / vitamin.
3. Perform preservative efficacy test



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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) Microbiology		
Course Type	Major		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSMB11803	Course Name	Introduction to Bioinformatics and “OMICS” Technology(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) Microbiology		
Course Type	Major		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSMB11804	Course Name	Introduction to Bioinformatics and “OMICS” Technology (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

Name of faculty: Science	Department: Microbiology
Program: B.Sc. (Hons.) Microbiology Sem-8	Type: Major
Subject: Introduction to Bioinformatics and “OMICS” Technologies	
Credit: 04	Total learning hours: 45
Course description: This course introduces the principles and applications of modern omics technologies, including genomics, transcriptomics, proteomics, metabolomics, metagenomics, and systems biology. It covers next-generation sequencing, functional genomics, gene expression analysis, biological databases, sequence analysis, structural bioinformatics, protein structure prediction, and computer-aided drug discovery. The practical component provides hands-on training in molecular biology and bioinformatics tools, preparing students for research and applications in microbiology, biotechnology, healthcare, food, environmental sciences, and computational biology.	
Student learning outcome: ➤ Understand the principles of major omics technologies and their role in biological research. ➤ Explain genomic, transcriptomic, proteomic, metabolomic, metagenomic, and systems biology approaches. ➤ Describe next-generation sequencing, functional genomics, gene expression analysis, and protein characterization techniques. ➤ Apply bioinformatics tools and databases for sequence analysis, gene annotation, and phylogenetic studies. ➤ Apply structural bioinformatics and computer-aided drug discovery tools for protein structure prediction, molecular interactions, and in silico drug evaluation. ➤ Perform basic laboratory and computational techniques for omics data analysis and interpret biological data for research applications. ➤ Evaluate the applications of omics and bioinformatics in microbiology, biotechnology, healthcare, food, environmental sciences, and drug discovery.	

Reference Books

- Christensen, H. (Ed.). (2018). *Introduction to Bioinformatics in Microbiology*. Springer.
- Choudhuri, S. (2014). *Bioinformatics for Beginners: Genes, Genomes, Molecular Evolution, Databases and Analytical Tools*. Academic Press.
- Low, L. W. Y., & Tammi, M. T. (Eds.). (2017). *Bioinformatics: A practical handbook of next-generation sequencing and its applications*. # N/A.
- Arivaradarajan, P., & Misra, G. (2018). *Omics approaches, technologies, and applications*. Springer, Singapore. doi, 10, 978-981.
- Primrose, S. B., & Twyman, R. (2013). *Principles of gene manipulation and genomics*. John Wiley & Sons.
- Xiong, J. (2006). *Essential bioinformatics*. Cambridge University Press.
- Brown, T. A. (2023). *Genomes 5*. CRC Press.
- Twyman, R. (2004). *Principles of proteomics*. Taylor & Francis.
- Rehm, H. (2006). *Protein biochemistry and proteomics*. Elsevier.
- Madigan, M. T., Bender, K. S., Buckley, D. H., Sattley, W. M., & Stahl, D. A. (2019). *Brock Biology of Microorganisms*. UK.
- Baidoo, E. E., & Benites, V. T. (2019). *Microbial Metabolomics. Methods in Molecular Biology*.



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Sem-VII and VIII

- *National Research Council, Board on Life Sciences, Committee on Metagenomics, & Functional Applications. (2007). The new science of metagenomics: revealing the secrets of our microbial planet.*
- *Kalia, V. C., Shouche, Y., Purohit, H. J., & Rahi, P. (Eds.). (2017). Mining of microbial wealth and metagenomics. Springer Singapore.*
- *Benedetti, C. (Ed.). (2014). Metagenomics: methods, applications and perspectives. Nova Publishers.*
- *Jerzy Długoński (Ed.) (2026). Microbial Biodegradation From Omics to Function and Application. Caister Academic Press.*
- *Ghosh, Z., & Mallick, B. (2008). Bioinformatics: principles and applications. Oxford University Press.*
- *Rastogi, S. C., Rastogi, P., & Mendiratta, N. (2008). Bioinformatics Methods And Applications: Genomics Proteomics And Drug Discovery 3Rd Ed. PHI Learning Pvt. Ltd.*
- *Baxevanis, A. D., & Ouellette, B. F. F. (Eds.). (2005). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins (3rd ed.). Wiley.*
- *Lesk, A. M. (2014). Introduction to Bioinformatics (4th ed.). Oxford University Press.*

Online Resources

- National Center for Biotechnology Information (NCBI): <https://www.ncbi.nlm.nih.gov>
- European Bioinformatics Institute (EMBL-EBI): <https://www.ebi.ac.uk>
- Protein Data Bank (PDB): <https://www.rcsb.org>
- UniProt Knowledgebase: <https://www.uniprot.org>
- AlphaFold Protein Structure Database: <https://alphafold.ebi.ac.uk>
- PubChem Database: <https://pubchem.ncbi.nlm.nih.gov>

Unit-1:	Genomics	(7 Hrs.)
2.1	Introduction to Omics technologies	
2.2	Next Generation Sequencing Technologies	
2.3	Genome Mapping	
2.4	Tools and techniques for Genome Assembling and Annotation	
2.5	Comparative Genomics: Comparative genomics of bacteria	
2.6	Functional Genomics	
2.7	Concepts and definition of other Omics: Transcriptomics, Proteomics, Metabolomics, Metatranscriptomics, Metaproteomics, Lipidomics, Glycomics, Culturomics, metagenomics.	
Unit-2:	Transcriptomics	(7 Hrs.)
2.1	Introduction to Transcriptomes and Transcriptomics	
2.2	Transcriptome Analysis Techniques	
2.2.1	RNA level Gene Expression: DNA Microarray-based technology, its Application and Printing technologies	
2.2.2	RNA-seq technology	
Unit-3:	Proteomics	(7 Hrs.)
3.1	From Genomics to Proteomics	
3.2	Interaction Proteomics: Methods of Protein-Protein Interaction	
3.3	Wet lab Techniques for proteomics data generation:	
3.3.1	2-D Differential gel electrophoresis	
3.3.2	Protein Microarray and its Application, Types and Manufacture of protein chip	
3.3.3	Mass Spectroscopy of Peptides and Protein	
3.3.4	Microsequencing	
3.4	Application of Proteomics	



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Unit-4: System Biology, Metabolomics and Metagenomics (7 Hrs.)

- 4.1 Introduction and Utility of Systems Biology
 - 4.1.1 Single-cell Genomics
 - 4.1.2 Integrating Mycobacterium tuberculosis omics
 - 4.1.3 Systems Biology and Human Health
- 4.2 Microbial Metabolomics and Applications of Metabolomics.
- 4.3 Metagenomics: Fundamental concepts, library construction, and screening methods
- 4.4 Mining Metagenomes for Novel Bioactive Molecules
- 4.5 Designing a Successful Metagenomics Project

Unit-5: Fundamentals of Bioinformatics and Sequence Alignment (8 Hrs.)

- 5.1 Introduction, Overview, Definition, Applications of Bioinformatics
- 5.2 Major Bioinformatics Resources: Sequence databases and 3D Protein structure database, Pathway database.
- 5.3 Basic Concepts of Sequence Analysis:
 - 5.3.1 Database searches, BLAST and FASTA
 - 5.3.2 Sequence Identity and Similarity, Homology
 - 5.3.3 Scoring matrix, pairwise sequence alignments, multiple sequence alignments (MSA), application in taxonomy and phylogeny.
- 5.4 Gene annotation: Prediction of gene function using homology

Unit 6: Structural Bioinformatics and Drug Discovery (9 Hrs.)

- 6.1 Protein 3-D structure visualization: PyMOL, RasMol
- 6.2 Protein Structure Analysis and Prediction
 - 6.2.1 Anatomy of proteins: Hierarchical organization of protein structure
 - 6.2.2 Secondary and tertiary structure prediction, homology/comparative modeling,
 - 6.2.3 AI-based methods of structure prediction (eg., AlphaFold).
- 6.3 Computer-Aided Drug Design
 - 6.3.1 Chemical Databases (NCI, PubChem)
 - 6.3.2 Fundamentals of Receptor–Ligand Interactions
 - 6.3.3 Structure-Based and Ligand-Based Drug Design
 - 6.3.4 Definition of Structure–Activity Relationship (SAR), QSAR and Pharmacophores
 - 6.3.5 *In silico* Prediction of Drug Activity and ADMET

List of Practicals

1. Separation of Protein by SDS-PAGE
2. Metagenomic DNA extraction and detection by gel electrophoresis.
3. A case study related to omics-based data analysis & interpretation.
4. Retrieval of nucleotide and protein sequences from biological databases
5. Sequence similarity search using BLAST
6. Sequence alignment: Pairwise sequence alignment and Multiple Sequence Alignment (MSA)
7. Construction and interpretation of phylogenetic trees
8. Protein structure prediction (Any one tool)



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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) Microbiology		
Course Type	Major		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSMB11805	Course Name	Food and Dairy Microbiology (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) Microbiology		
Course Type	Major		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSMB11806	Course Name	Food and Dairy Microbiology (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: Sciences	Department: Microbiology
Program: B.Sc. (Hons.) Microbiology Sem-8	Type: Major
Subject: Food and Dairy Microbiology	
Credit: 4	Duration: 45 hours
Course description: This course provides comprehensive knowledge of microorganisms associated with foods and milk, their role in food spoilage, preservation, foodborne diseases, and quality assessment. It also covers microbial analysis of milk, food safety regulations, quality control systems, and modern approaches to ensuring food quality and public health.	
Learning Outcomes: Upon successful completion of this course, students will be able to: • Explain the microbial ecology of foods and milk, including factors affecting microbial growth and survival. • Describe food and milk spoilage, foodborne diseases, and their causative microorganisms. • Apply principles of food and milk preservation and microbiological quality assessment. • Perform and interpret standard microbiological tests used in food and dairy quality control. • Evaluate food safety systems, quality standards, and regulatory requirements for ensuring safe food production.	

Reference:

1. Adams, M.R. and Moss, M.O. (1995). Food Microbiology. 2nd edition, Royal Society of Chemistry. ISBN: 0-85404-61 1-9
2. Doyle, M.P., Beuchat LR and Montville TJ. (2001). Food Microbiology: Fundamentals and Frontiers. 2nd edition, ASM Press, USA. ISBN: 9781555811174
3. Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India. ISBN: 978-1-25-906251-3
4. Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th edition, Springer Science and Business Media, Inc., New York. ISBN: 0-387-23180-3
5. Mahanta KC. (1984). Dairy Microbiology. 2nd edition, Omsons Publication, New Delhi, India.
6. Marth EH and Steele JL. (2001). Applied Dairy Microbiology. 2nd edition, Marcel Dekker, New York. ISBN: 9780824705367

Further reading:

1. Robinson R.K. (2002). Dairy Microbiology Handbook: The Microbiology of Milk and Milk Products. 3rd edition, John Wiley and Sons, Inc., New York. ISBN: 0-471-38506-4

Unit 1: Fundamentals of Food Microbiology

(6 Hours)

- 1.1 Microflora of Foods: Origin, sources, and incidence of microorganisms in food
- 1.2 Intrinsic parameters affecting microbial growth and survival
- 1.3 Extrinsic parameters affecting microbial growth and survival



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Unit 2: Food Spoilage and Food Preservation

(10 Hours)

- 2.1 Spoilage of food: fresh meat, poultry, processed meat and sea foods, vegetables and fruits, bread, eggs, and canned foods
- 2.2 Physical methods of food preservation:
 - 2.2.1 Physical dehydration processes: Drying, Freeze-drying
 - 2.2.2 Low temperature: Cool storage, Freezing and frozen storage
 - 2.2.3 Heat treatments: Determination of TDP, TDT, *D*, *z* and *F* values, Microwave heat treatment and Ohmic heating
 - 2.2.4 Irradiation: UV, high-intensity pulsed light, ionizing radiation
- 2.3 Chemical methods of food preservation:
 - SO₂, Nitrite and Nitrates, Salt and Sugar, Organic acids, Antibiotics, Ethylene oxide, and Bacteriocins, High hydrostatic pressure, Aseptic packaging

Unit 3: Food Infection and Food Poisoning

(7 Hours)

- 3.1 Food intoxications: *Staphylococcus aureus*, *Clostridium botulinum* and *Aspergillus spp.* (Aflatoxin)
- 3.2 Food infections: *Bacillus cereus*, *Vibrio parahaemolyticus*, *Escherichia coli*, *Salmonellosis*, *Shigellosis*, *Yersinia enterocolitica*, *Listeria monocytogenes* and *Campylobacter jejuni*

Unit 4: Microbiology of Milk and Milk Preservation

(10 Hours)

- 4.1 Microflora of raw milk and Sources of micro-organisms in milk
- 4.2 Spoilage of milk products
- 4.3 Milk borne diseases: Diphtheria, Brucellosis, Q fever, Bovine Tuberculosis, Mastitis
- 4.4 Preservation of milk: Asepsis, Use of heat (Pasteurization), Steam under pressure, Use of low temperatures, Drying, Use of preservatives

Unit 5: Microbial Analysis of Milk

(6 Hours)

- 5.1 SPC, Direct microscopic count, Burri's smear method, Dye reduction test (methylene blue and resazurin) and Grading of milk
- 5.2 Phosphatase test of milk, Alizarin alcohol test
- 5.3 Tube Coagulase Test – TCT for detection of *Staphylococcus aureus* in milk.

Unit 6: Food Laws and Quality Control

(6 Hours)

- 6.1 Quality control criteria
- 6.2 Codes of GMP
- 6.3 Food Laws
 - 6.3.1 Statutory Food Laws & Regulatory Authorities: FSSAI, PFA, FDA
 - 6.3.2 Food Quality & Standardization Marks: AGMARK, BIS
 - 6.3.3 Risk-Management System that guide Global Food Safety Standards: HACCP

List of Practicals

- 1) Bacteriological analysis of food.
- 2) Bacteriological analysis of milk (MBRT, Qualitative, Quantitative, AFB staining)
- 3) Analysis of milk (Fat, titratable acidity, chloride value, lactose estimation by iodometric method)



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Faculty	Science		Program	B.Sc. (Hons.) / (Hons. with Research) Microbiology		
Course Type	Major		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSMB11807	Course Name	Microbial Pathogenicity (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) Microbiology		
Course Type	Major		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSMB11808	Course Name	Microbial Pathogenicity (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.) Microbiology Sem-8	Type: Major
Subject: Microbial Pathogenicity	
Credit: 04	Total learning hours: 45
Course description: This course provides an understanding of microbial pathogenicity, host–pathogen interactions, and the molecular mechanisms of disease causation. It covers virulence factors, regulation of pathogenicity, emerging and re-emerging infectious diseases, molecular epidemiology, antimicrobial resistance, environmental influences on disease transmission, vaccines, alternative therapeutic approaches, and modern molecular diagnostic technologies. The course emphasizes the application of genomic, epidemiological, and diagnostic tools for the surveillance, prevention, and control of infectious diseases.	
Student learning outcome: After successful completion of the course, students will be able to: 1. Explain the mechanisms of microbial pathogenicity and virulence. 2. Describe molecular basis of host–pathogen interactions. 3. Analyze factors responsible for emerging and re-emerging infectious diseases. 4. Apply molecular epidemiological tools for disease surveillance and outbreak investigation. 5. Evaluate antimicrobial resistance mechanisms and disease control strategies. 6. Explain the principles and applications of modern vaccines and rapid diagnostic technologies.	

References:

- Riedel, S., & Morse, S. A. (2026). Jawetz, Melnick & Adelberg's Medical Microbiology Twenty. McGraw-Hill Professional.
- Gottfried Uden, Eckhard Thines, and Anja Schöffler (2016), Host – Pathogen Interaction Microbial Metabolism, Pathogenicity and Antiinfectives
- Wilson, B. A., Winkler, M., & Ho, B. T. (2020). Bacterial pathogenesis: a molecular approach. John Wiley & Sons.
- Nelson, K. E., & Williams, C. M. (Eds.). (2014). Infectious disease epidemiology: theory and practice. Jones & Bartlett Publishers.
- Greenwood, D., Slack, R. C., Barer, M. R., & Irving, W. L. (2012). Medical microbiology e-book: A guide to microbial infections: Pathogenesis, immunity, laboratory diagnosis and control. Elsevier Health Sciences.
- Hacker J and Dorbindt U. (2006), Pathogenomics: Genome analysis of pathogenic microbes by ed. Wiley-VCH.
- Persing DH, Tenover FC, Versalovic J, Tang Y, Unger ER, Relman DA, White TJ (2004), Molecular Microbiology: Diagnostic Principles and Practice by eds. American Society for Microbiology Press.

UNIT 1: Concepts of Microbial Pathogenicity

(07 Hrs.)

- 1.1 Identifying bacteria that cause disease
- 1.2 The infectious process



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- 1.3 Genomics and bacterial pathogenicity
- 1.4 Regulation of bacterial virulence factors
- 1.5 Bacterial virulence factors
 - 1.5.1 Adherence Factors
 - 1.5.2 Invasion of Host Cells and Tissues
 - 1.5.3 Toxins
 - 1.5.4 Enzymes
- 1.6 Measuring Infectivity and Virulence

UNIT 2: Molecular Basis of Microbial Pathogenicity

(08 Hrs.)

- 2.1 Microbes and Disease: Establishing a Connection
 - 2.1.1 Molecular Koch's postulates
 - 2.1.2 Concepts of Disease
- 2.2 Delivery of Virulence Factors
 - 2.2.1 Bacterial Secretion Systems
 - 2.2.2 Secretion Systems Specific to Gram-Negative Bacteria
 - 2.2.3 Secretion Systems Specific to Gram-Positive Bacteria
- 2.3 Regulation of virulence
 - 2.3.1 Types of regulation
 - 2.3.2 Quorum sensing
- 2.4 Biofilms
- 2.5 Pathogenicity islands (PAI)
- 2.6 Host-pathogen interactions
 - 2.6.1 The Human Microbiome in Health and Disease

UNIT 3: Emerging and Re-emerging Infectious Diseases

(08 Hrs.)

- 3.1 Emerging and New Infectious Diseases
 - 3.1.1 Factors in the Emergence of Infectious Diseases
 - 3.1.2 Newly Discovered Pathogens
- 3.2 Bacterial pathogens and associated diseases
 - 3.2.1 Cholera
 - 3.2.2 Tuberculosis
 - 3.2.3 *H. pylori*
 - 3.2.4 *Escherichia*
 - 3.2.5 Lyme disease
 - 3.2.6 *Chlamydia*
- 3.3 Viral pathogens and associated diseases
 - 3.3.1 Influenza
 - 3.3.2 HIV/AIDS
 - 3.3.3 Dengue
 - 3.3.4 Coronaviruses
- 3.4 Fungal pathogens

UNIT 4: Molecular Microbial Epidemiology

- 4.1 Surveillance
- 4.2 Outbreak investigation
- 4.3 Source tracking



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- 4.4 Typing methods
- 4.5 Molecular epidemiology
- 4.6 WGS
- 4.7 Metagenomics
- 4.8 GIS

UNIT 5: Environmental Change, AMR and Disease Spread

- 5.1 Climate change
- 5.2 Vector-borne diseases
- 5.3 Urbanization
- 5.4 One Health
- 5.5 Antimicrobial resistance
- 5.6 ESBL
- 5.7 Carbapenemases
- 5.8 MRSA
- 5.9 MDR/XDR TB

UNIT 6: Rapid Diagnostic Technologies, New Vaccines, and Alternative Therapy

- 6.1 Rapid Diagnostic Technologies
 - 6.1.1 PCR & Digital PCR
 - 6.1.2 Sequencing
 - 6.1.3 Microarrays
 - 6.1.4 NGS diagnostics
- 6.2 New Vaccines
 - 6.2.2 Recombinant vaccines
 - 6.2.3 DNA vaccines
 - 6.2.4 Viral vectors
 - 6.2.5 mRNA vaccines
- 6.3 Alternative therapy:
 - 6.3.2 Phage therapy
 - 6.3.3 Antimicrobial peptides
 - 6.3.4 Fecal transplantation
 - 6.3.5 Probiotic

List of Practicals

1. Detection of hemolytic activity on blood agar of pathogen.
2. Identification of bacterial pathogens from clinical specimen using biochemical methods.
3. Detection of Antibiotic susceptibility of bacterial pathogen by Kirby–Bauer method and Determination of Minimum Inhibitory Concentration (MIC) of selected antibiotic.
4. Study of biofilm formation.
5. Detection of ESBL-producing bacteria.
6. Detection of MRSA by phenotypic methods.



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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
- 1.6. Assessment of Mixing Effectiveness



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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_La
 - 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
 - 6.2.2 Proteases
- 6.3 Microbial Biomass Production



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- 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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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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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	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 electronic 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 Ni²⁺ in water sample by Spectrophotometer. 4. Determination of F⁻ in water sample by Spectrophotometer. 5. To determine NO₃⁻ of water sample. 6. Determination of NH₃ in water sample by Spectrophotometer.



SARVAJANIK UNIVERSITY

FACULTY OF SCIENCE

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

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 Engineering; A. Nag; 1st Edition, 2006, Prentice Hall of India. • Analytical Chemistry, H. Kaur, 1st Edition, 2013, Pragati Prakashan.
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FACULTY OF SCIENCE

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



SARVAJANIK UNIVERSITY
FACULTY OF SCIENCE

B.Sc. (Honours) (Microbiology) / B.Sc. (Honours with Research) (Microbiology)
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*.



SARVAJANIK UNIVERSITY

FACULTY OF SCIENCE

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

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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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	BSES12803	Course Name	Occupational Health and Industrial Safety (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	40	35	75

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	BSES12804	Course Name	Occupational Health and Industrial Safety (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CA)	Term end examinations (TEE)	Total
1	0	0	2 hrs	10	15	25



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FACULTY OF SCIENCE
B.Sc. (Honours) (Microbiology) / B.Sc. (Honours with Research) (Microbiology)
Sem-VII and VIII

Subject code: Minor	Department: Environmental Science
Program: B. Sc.	Type of Subject: Theory + Practical
Subject: Occupational Health and Industrial Safety	
Semester-8	
Course Description: 1. This course provides a comprehensive understanding of occupational health and safety principles, workplace hazards, risk assessment, occupational diseases, industrial hygiene. 2. It develops examine ability of students impact of workers, workplace environments, industrial processes, machinery, chemicals, biological agents, and organizational practices that influence occupational health and safety. 3. The course also introduces occupational health surveillance, personal protective equipment, workplace monitoring, accident investigation, safety audits, emergency response, and relevant Indian occupational health and safety legislation.	
Student Learning Outcomes (SLOs): 1. Recognize major classes of occupational and environmental contaminants and how to apply to them the basic industrial hygiene tenets of anticipation, recognition, evaluation and control. 2. Correctly use and handle basic industrial hygiene assessment and analysis instrumentation and will understand the types and selection of Personal Protective Equipment used in practice	

References and Textbooks: (With Author, Edition, Publishers, ISBN)

1. M. H. Fulekar (I.K. International Publishing House Pvt. Ltd., New Delhi), Industrial Hygiene and Chemical Safety. ISBN: 81-88237-92-2.
2. Koren Herman and Bisesi Michael (Lewis Publishers), Handbook of Environmental Health, Volume 1 and 2. ISBN: 1-56670-536-3.
3. Gatchel Robert J. and Schultz Izabela Z. (Springer Publications) Handbook of Occupational Health and Wellness. ISBN: 978-1-4614-4838-9
4. Farzana Zahir (Bentham Books) Frontiers in occupational health and safety. Introduction to occupational health hazards. Volume 1 and 2. ISBN: 978-981-14-0690-4.

UNIT-1: Industrial Hygiene and Chemical Safety

07 Hours

- 1.1 Industrial Hygiene, principles and practices
- 1.2 Chemical agents at workplace
- 1.3 Chemical Safety
- 1.4 Occupational Safety and Health Legislations - OHSAS18001, ILO Conventions, The Factories Act, 1948, Water (Prevention & control of pollution) Act, 1974, Air (Prevention & control of pollution) Act, 1981 and Rules. Environment protection Act 1986 (Amended)



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Sem-VII and VIII

UNIT-2: Concept of Industrial Hygiene

08 Hours

- 2.1 Introduction
- 2.2 Industrial hygiene and Industrial hygienist
- 2.3 Recognition, Evaluation, Monitoring and Control of Industrial Hygiene
- 2.4 Physical and Chemical Classification of Airborne Contaminants

UNIT-3: Physical and Chemical Stress in Industry

07 Hours

- 3.1 Introduction
- 3.2 Physical Stress: Noise, Vibrations, Heat and Illumination
- 3.3 Chemical Stress: Paining, Metal Coating, Electroplating
- 3.4 Basic preventive measures
- 3.5 Proposed Biological Monitoring Methods in Occupational Exposure
- 3.6 Benefits of Environmental Monitoring

UNIT-4: Occupational Diseases

08 Hours

- 4.1 Pneumoconiosis
- 4.2 Silicosis
- 4.3 Asbestosis
- 4.4 Lead and its Compounds
- 4.5 Mercury, Chromium and its Compounds

UNIT-5: Operational Control Measures

08 Hours

- 5.1 Introduction and Operation Control
- 5.2 Air Pollution Control Measures
- 5.3 Plant Strategies
- 5.4 Air Sampling Calibration
- 5.5 Interpretation of results

UNIT-6: Personal Protective Equipment

08 Hours

- 6.1 Introduction, legal requirements and selection guidelines
- 6.2 Head, eye and face protection
- 6.3 Hand, leg and foot protection
- 6.4 Respirators and canisters
- 6.5 Indian Standards on Personal Protective Equipment

Practicals:

1. Assessment of air flora of different places by gravity settling technique.
2. Study of safety in industries by suggesting safety measures and PPE.
3. Prepare OHS Policy for a medium sized organization.
4. Prepare an Organisation Chart & define roles & responsibilities.
5. Conduct any two Active monitoring systems & make a report: (a) Site Inspection (b) Survey of Safe Systems (c) Health surveillance of workers.



SARVAJANIK UNIVERSITY**FACULTY OF SCIENCE****B.Sc. (Honours) (Microbiology) / B.Sc. (Honours with Research) (Microbiology)****Sem-VII and VIII**

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. Microbiology (Hons.)		
Course Type	SEC		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSMB15801	Course Name	Research Methodology - II			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CA)	Term end examinations (TEE)	Total
2	2 hrs	0	0 hrs	25	25	50



SARVAJANIK UNIVERSITY
FACULTY OF SCIENCE

B.Sc. (Honours) (Microbiology) / B.Sc. (Honours with Research) (Microbiology)
Sem-VII and VIII

Name of faculty: Science	Department: Microbiology
Program: B.Sc. (Hons.) Sem-8	Type: SEC-2
Subject: Research Methodology-II	
Credit: 02	Total learning hours: 30
Course description: This course focuses on the practical aspects of conducting and communicating scientific research. It covers data collection and processing, literature citation and reference management, preparation of research reports, scientific writing, research proposal development, publication of research findings, the role of computers in research, and research ethics including plagiarism. The course equips students with the skills required to collect, organize, analyze, and present research findings effectively while adhering to ethical and academic standards.	
Student learning outcome: ➤ Upon successful completion of this course, students will be able to: ➤ Understand the methods of data collection, processing, and preparation for scientific research. ➤ Apply appropriate citation styles and reference management tools in scientific writing. ➤ Prepare research reports, tables, figures, graphs, and research proposals following standard scientific formats. ➤ Demonstrate effective scientific writing and publication practices using computer-based tools. ➤ Apply the principles of research ethics and academic integrity by identifying and avoiding plagiarism.	

References:

- Kumar, R. (2005). *A Step-by-step Guide for Beginners*. Sage Publications. (ISBN: 9788132106487)
- Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International. (ISBN: 978-81-224-2488-1)
- Gurumani N. (2011) *Research Methodology For Biological Sciences*, MJP Publishers, Chennai (ISBN: 978-81-8094-016-0)
- Bairagi, V., & Munot, M. V. (Eds.). (2019). *Research methodology: A practical and scientific approach*. CRC Press.
- McMillan, K., & Weyers, J. (2007). *How to write dissertations & project reports*. Pearson Education.

Further Reading:

- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Patwardhan, B., Desai, A., Chourasai, A., Nag, S., & Bhatnagar, R. (2020). *Guidance Document Good Academic Research Practices*.
- University Grants Commission. (2021). *Academic Integrity and Research Quality*.

Online Resource:

- <https://www.mendeley.com>



SARVAJANIK UNIVERSITY

FACULTY OF SCIENCE

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Sem-VII and VIII

UNIT: 1 Data Collection & Data Processing (Duration: 08 Hrs)

- 1.1 Types of research
- 1.2 Primary & secondary data
- 1.3 Collection of primary data
- 1.4 Collection of secondary data
- 1.5 Selection of appropriate method for data collection
- 1.6 Data processing: Editing, Coding, Classification

UNIT: 2 Literature citation (Duration: 07 Hrs)

- 2.1 Introduction and Learning Outcomes
 - 2.1.1 Citation Identifiers
 - 2.1.2 Purpose and Importance of Citation
 - 2.1.3 Structure of Citation
 - 2.1.4 Citation Style
- 2.2 Citation in text
- 2.3 Placement of reference section
- 2.4 Format of reference section
- 2.5 Online Reference Management

UNIT: 3 Research Report (Duration: 07 Hrs)

- 3.1 Components of research report
- 3.2 Research report - Formatting & typing
- 3.3 Research Report – Tables & Figures
 - 3.3.1 Introduction and placement of tables, Format of table and types of tables
 - 3.3.2 Introduction and placement of figures, Numbering & caption of figures
 - 3.3.3 Preparation of statistical diagrams and graphs.

UNIT: 4 Writing a Research proposal & report (Duration: 08 Hrs)

- 4.1 Content of research proposal
- 4.2 Interpretation and Report Writing
 - 4.2.1 Techniques, precautions, and significance of report writing
 - 4.2.2 Different steps in writing a report
 - 4.2.3 layout of the research report
 - 4.2.4 Types of reports
- 4.3 Presenting and Publishing the Research Findings
 - 4.3.1 Types of Publication
 - 4.3.2 Body of Research Papers, Reports, and Theses
- 4.4 Role of Computer in Research
- 4.5 Plagiarism
 - 4.5.1 Reasons for Plagiarism
 - 4.5.2 Types of Plagiarism
 - 4.5.3 Software Used for Identifying Plagiarism
 - 4.5.4 Techniques to Avoid Plagiarism
- 4.6 Research Ethics



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. Microbiology (Hons. with Research)		
Course Type	Research Project		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSMB18801	Course Name	Research Project - II (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CA)	Term end examinations (TEE)	Total
2	2 hrs	0	0 hrs	50	50	100

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	B.Sc. Microbiology (Hons. with Research)		
Course Type	Research Project		Version	1.0		
Semester	08		Effective From	June, 2026		
Course Code	BSMB18802	Course Name	Research Project - II (PR)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CA)	Term end examinations (TEE)	Total
4	0 hrs	0	8 hrs	50	50	100



SARVAJANIK UNIVERSITY**FACULTY OF SCIENCE****B.Sc. (Honours) (Microbiology) / B.Sc. (Honours with Research) (Microbiology)****Sem-VII and VIII**

Name of faculty: Science	Department: Microbiology
Program: B.Sc. (Hons. with research) Sem-8	Type: SEC-2
Subject: Research Project-II	
Credit: 02	Total learning hours: 30
Course description: This course focuses on the practical aspects of conducting and communicating scientific research. It covers data collection and processing, literature citation and reference management, preparation of research reports, scientific writing, research proposal development, publication of research findings, the role of computers in research, and research ethics including plagiarism. The course equips students with the skills required to collect, organize, analyze, and present research findings effectively while adhering to ethical and academic standards.	
Student learning outcome: ➤ Upon successful completion of this course, students will be able to: ➤ Understand the methods of data collection, processing, and preparation for scientific research. ➤ Apply appropriate citation styles and reference management tools in scientific writing. ➤ Prepare research reports, tables, figures, graphs, and research proposals following standard scientific formats. ➤ Demonstrate effective scientific writing and publication practices using computer-based tools. ➤ Apply the principles of research ethics and academic integrity by identifying and avoiding plagiarism.	

References:

- Kumar. R. (2005). *A Step-by-step Guide for Beginners*. Sage Publications. (ISBN: 9788132106487)
- Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International. (ISBN: 978-81-224-2488-1)
- Gurumani N. (2011) *Research Methodology For Biological Sciences*, MJP Publishers, Chennai (ISBN: 978-81-8094-016-0)
- Bairagi, V., & Munot, M. V. (Eds.). (2019). *Research methodology: A practical and scientific approach*. CRC Press.
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- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Patwardhan, B., Desai, A., Chourasai, A., Nag, S., & Bhatnagar, R. (2020). *Guidance Document Good Academic Research Practices*.
- University Grants Commission. (2021). *Academic Integrity and Research Quality*.

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SARVAJANIK UNIVERSITY
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Sem-VII and VIII

UNIT: 1 Data Collection & Data Processing (Duration: 08 Hrs)

- 1.7 Types of research
- 1.8 Primary & secondary data
- 1.9 Collection of primary data
- 1.10 Collection of secondary data
- 1.11 Selection of appropriate method for data collection
- 1.12 Data processing: Editing, Coding, Classification

UNIT: 2 Literature citation (Duration: 07 Hrs)

- 4.1 Introduction and Learning Outcomes
 - 4.1.1 Citation Identifiers
 - 4.1.2 Purpose and Importance of Citation
 - 4.1.3 Structure of Citation
 - 4.1.4 Citation Style
- 4.2 Citation in text
- 4.3 Placement of reference section
- 4.4 Format of reference section
- 4.5 Online Reference Management

UNIT: 3 Research Report (Duration: 07 Hrs)

- 6.1 Components of research report
- 6.2 Research report - Formatting & typing
- 6.3 Research Report – Tables & Figures
 - 6.3.1 Introduction and placement of tables, Format of table and types of tables
 - 6.3.2 Introduction and placement of figures, Numbering & caption of figures
 - 6.3.3 Preparation of statistical diagrams and graphs.

UNIT: 4 Writing a Research proposal & report (Duration: 08 Hrs)

- 8.1 Content of research proposal
- 8.2 Interpretation and Report Writing
 - 8.2.1 Techniques, precautions, and significance of report writing

