



॥ तमसो मा ज्योतिर्गमय ॥

VISION

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

MISSION

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



SARVAJANIK
UNIVERSITY

INCLUSIVE | INTEGRATED | INNOVATIVE

creating an enlightened society...

UNIVERSITY OFFICE

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CURRICULUM FOR

“MASTER OF SCIENCE (MICROBIOLOGY)”

M.Sc. (Microbiology)

SEM – 1

SEM – 2

w.e.f. Academic Year 2026-27

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

Course Curriculum **MASTER OF SCIENCE (MICROBIOLOGY) Sem-1 and 2**

The Course Curriculum of Master 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 <u>Sarvajani University Office</u>	 Sign
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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 <u>Sarvajani University Office</u>	 Sign
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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 <u>Sarvajani University Office</u>	 Sign
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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 <u>Sarvajani University Office</u>	 Sign
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- *The approved curriculum of Master of Science (Microbiology) is with effect from the Academic year 2026-27*

SARVAJANIK UNIVERSITY
FACULTY OF SCIENCE
Master of Science (Microbiology) Sem-I and II



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Faculty of Science

M. Sc. (Microbiology)

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



SARVAJANIK UNIVERSITY
FACULTY OF SCIENCE
Master of Science (Microbiology) Sem-I and II

Credit Framework for 2 Years Postgraduate Program (As per KCG SOP) wef 2026-27
Faculty of Science, Sarvajani University

Semester	DSC						DSE		Skill Enhancement		Total Credits
	DSC No. of Papers	Theory		Lab		Total DSC Credits					
		Theory Hours	Theory Credits	Lab Hrs	Lab Credits		No. of Papers	Credits	No. of Papers	Credits	
1	4	3+3+3+3	3+3+3+3	2+2+2+2	1+1+1+1	16	1	4	1	2	22
2	4	3+3+3+3	3+3+3+3	2+2+2+2	1+1+1+1	16	1	4	1	2	22
3	4	3+3+3+3	3+3+3+3	2+2+2+2	1+1+1+1	16	1	4	1	2	22
4	Dissrt.			48	16	16	1	4	1	2	22
Total after 2yrs	12 + 1					64	4	16	4	8	88



SARVAJANIK UNIVERSITY
FACULTY OF SCIENCE
Master of Science (Microbiology) Sem-I and II

Teaching Scheme for M.Sc. (Organic Chemistry) Semester – I to II						
Semester	Course Category	Credits	Theory (Hrs/Week)	Theory (Total)	Laboratory (Hrs/Week)	Laboratory (Total)
I	Discipline Specific Core-1	4	3	45	2	30
	Discipline Specific Core-2	4	3	45	2	30
	Discipline Specific Core-3	4	3	45	2	30
	Discipline Specific Core-4	4	3	45	2	30
	Discipline Specific Elective-1	4	3	45	2	30
	Skill Enhancement Courses-1	2	2	30	-	-
	Total	22	17	255	10	150
II	Discipline Specific Core-5	4	3	45	2	30
	Discipline Specific Core-6	4	3	45	2	30
	Discipline Specific Core-7	4	3	45	2	30
	Discipline Specific Core-8	4	3	45	2	30
	Discipline Specific Elective-2	4	3	45	2	30
	Skill Enhancement Courses-2	2	2	30	-	-
	Total	22	17	255	10	150



SARVAJANIK UNIVERSITY
FACULTY OF SCIENCE
Master of Science (Microbiology) Sem-I and II

Evaluation Scheme for M.Sc. (Organic Chemistry) Semester – I to II							
Semester	Course Category	Continuous and Comprehensive Evaluation (CCE)			Total CCE	Semester End Examination (SEE)	Grand Total
		CCE	Assignment	Attendance			
I	Discipline Specific Core-1	30	10	10	50	50	100
	Discipline Specific Core-2	30	10	10	50	50	100
	Discipline Specific Core-3	30	10	10	50	50	100
	Discipline Specific Core-4	30	10	10	50	50	100
	Discipline Specific Elective-1	30	10	10	50	50	100
	Skill Enhancement Courses-1	15	5	5	25	25	50
II	Discipline Specific Core-5	30	10	10	50	50	100
	Discipline Specific Core-6	30	10	10	50	50	100
	Discipline Specific Core-7	30	10	10	50	50	100
	Discipline Specific Core-8	30	10	10	50	50	100
	Discipline Specific Elective-2	30	10	10	50	50	100
	Skill Enhancement Courses-2	15	5	5	25	25	50



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Faculty of Science
M. Sc. (Microbiology)
SEM – 1

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



SARVAJANIK UNIVERSITY
FACULTY OF SCIENCE
Master of Science (Microbiology) Sem-I and II

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M.Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	01		Effective From	June, 2026		
Course Code	MSMB21101	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	M.Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	01		Effective From	June, 2026		
Course Code	MSMB21102	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



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FACULTY OF SCIENCE
Master of Science (Microbiology) Sem-I and II

Name of faculty: Science	Department: Microbiology
Program: M.Sc. Microbiology Sem-1	Type: DSC-1
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 characterized, 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.
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



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FACULTY OF SCIENCE
Master of Science (Microbiology) Sem-I and II

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, Subarata Kumar Das (2019). Springer Nature. Singapore. ISBN:978-981-13-8314-4, ISBN:978-981-133-8315-1
- The Prokaryotes . 3rd Edtn, A Handbook on Biology of Bacteria: Ecophysiology and Biochemistry. Vol 2. Martin Dworkin, Stanley Falkow, Eugene Rosenberg, Karl-Heinz Schlefer, Erko Stackbrandt. (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. ISBN 978-1-259-28159-4

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 antibiotics 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

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



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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

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



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Master of Science (Microbiology) Sem-I and II

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M.Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	01		Effective From	June, 2026		
Course Code	MSMB21103	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	M.Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	01		Effective From	June, 2026		
Course Code	MSMB21104	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



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Master of Science (Microbiology) Sem-I and II

Name of faculty: Science	Department: Microbiology
Program: M.Sc. Microbiology Sem-I	Type: DSC-2
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 Mohapaatra. 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 .Waste Water 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
- 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).



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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	M.Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	01		Effective From	June, 2026		
Course Code	MSMB21105	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	M.Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	01		Effective From	June, 2026		
Course Code	MSMB21106	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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Master of Science (Microbiology) Sem-I and II

Name of Faculty: Sciences	Department: Microbiology
Program: M.Sc. Microbiology Sem-1	Type: DSC-3
Subject: Advances in Virology	
Credit: 4	Total learning hours: 45
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

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.



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Unit 3: Replication of viruses

(7 Hours)

- 3.1 Outline of the virus replication cycle.
- 3.2 Investigation of virus replication
- 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 virion 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

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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FACULTY OF SCIENCE
Master of Science (Microbiology) Sem-I and II

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M.Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	01		Effective From	June, 2026		
Course Code	MSMB21107	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	M.Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	01		Effective From	June, 2026		
Course Code	MSMB21108	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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Master of Science (Microbiology) Sem-I and II

Name of faculty: Science	Department: Microbiology
Program: M. Sc. Microbiology Sem-1	Type: DSC-4
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 978-1-009-18060-3
- 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
- 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



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Master of Science (Microbiology) Sem-I and II

- 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
- 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



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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
 - 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	M.Sc. Microbiology		
Course Type	DSE		Version	2.0		
Semester	01		Effective From	June, 2026		
Course Code	MSMB22101	Course Name	Bioanalytical Techniques (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	M.Sc. Microbiology		
Course Type	DSE		Version	2.0		
Semester	01		Effective From	June, 2026		
Course Code	MSMB22102	Course Name	Bioanalytical Techniques (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
Master of Science (Microbiology) Sem-I and II

Name of Faculty: Sciences	Department: Microbiology
Program: M.Sc. Microbiology Sem-I	Type: DSE-1
Subject: Bioanalytical Techniques	
Credit: 4	Duration: 45 hours
Course description: The objective of this course is to study of the various separation and the spectroscopic techniques for the detection of bio-analytes	
Learning Outcomes: • Make use of the centrifuge and Flow cytometry • Apply chromatography and electrophoresis techniques in the separation of biomolecules. • Estimation and identification of molecules in biological samples by spectroscopic techniques.	

Reference:

- Wilson K and Walker J: *Principles and Techniques of Biochemistry and Molecular Biology*. Cambrige University Press (Low price edition), New York, 6th ed.
- Khandpur R S (2008): *Handbook of analytical instruments*. Tata McGraw-Hill Publishing Company Limited (New Delhi), 2nd ed.
- Webster J G (2009): *Bioinstrumentation*. Wiley India (P) Ltd. New Delhi. (Student ed.)
- Upadhyay A., Upadhyay K and Nath N. (2003): *Biophysical Chemistry (Principles and Techniques)*. Himalaya Publishing House, 8th ed.
- Khopkar S M (2008): *Basic concepts of Analytical Chemistry*. New age international publishers (New Delhi), 3rd ed.
- Sharma B K (2005): *Instrumental methods of chemical analysis*. GOEL publishing house, Meerut, 24th ed.

Unit 1: Important Biological Instrument

(7 Hours)

- a. Centrifugation
 - 1.1.1. Basic Principles of sedimentation
 - 1.1.2. Types, Care and Safety Aspects of Centrifuge
 - 1.1.3. Preparative centrifugation
 - 1.1.4. Analytical Ultracentrifugation
- 1.2 Flow cytometry
 - 1.2.1 Introduction
 - 1.2.2 Instrumentation
 - 1.2.3 FACS
 - 1.2.4 Applications



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Master of Science (Microbiology) Sem-I and II

Unit 2: Spectroscopic Techniques - I

(8 Hours)

- 2.1 General properties of electromagnetic radiation
- 2.2 The electromagnetic spectrum
- 2.3 Interactions of radiation and matter
- 2.4 Transmittance, Absorbance & Beer & Lambert's law
- 2.5 UV/Vis Spectrometry
 - 2.5.1 Instrument component
 - 2.5.2 Types of instruments – Single and double beam
 - 2.5.3 Applications of UV/Vis Spectroscopy
- 2.6 IR Spectrometry
 - 2.6.1 Theory of IR absorption spectrometry
 - 2.6.2 Sample preparation
 - 2.6.3 Instrument component
 - 2.6.4 Application of IR spectrometry

Unit 3: Spectroscopic Techniques – II

(6 Hours)

- 3.1 Mass Spectrometry
 - 3.1.1 Introduction
 - 3.1.2 Methods of ionization
 - 3.1.3 Components of Mass Spectrometers
 - 3.1.4 Types of mass analyzers
 - 3.1.5 Types of Mass spectrometers
 - 3.1.6 Tandem Mass Spectrometry
 - 3.1.7 Application of Mass spectrometry

Unit 4: Separation Techniques – I

(10 Hours)

- 4.1 Chromatography: General principles and Chromatographic performance parameters
- 4.2 Types of chromatography: Liquid & Gas
- 4.3 Liquid chromatography: Principles and applications of Column, Thin-layer, Partition, Adsorption, Ion-exchange, Size-exclusion, Affinity. HPLC
- 4.4 Gas chromatography: Principles, Classification: GSC & GLC, Components of instrument- Carrier gas, Sample injection systems, Columns and Detectors. Principle and applications of GC-MS.

Unit 5: Separation Techniques – II

(7 Hours)

- 5. Electrophoresis
 - 5.1 General principles
 - 5.2 Modes of electrophoresis
 - 5.3 Support media
 - 5.4 Types of electrophoresis - Horizontal, Vertical and two dimensional
 - 5.5 Principle and applications - Paper electrophoresis, Starch gel electrophoresis, Disc gel, Agarose gel, SDS – PAGE, Immunoelectrophoresis.



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Unit 6: Radioisotopic techniques

(7 Hours)

6.1 Fundamentals of Radiochemical methods

- 6.1.1 Time decay of radioactive isotopes
- 6.1.2 Units of Radio activity
- 6.1.3 Types and Properties of particles emitted in radio active decay
- 6.1.4 Interaction of radiation with matter

6.2 Detection and measurement of radioactivity - Geiger- Muller and Scintillation counters,

6.3 Auto radiography and its applications.

List of Practical

1. Separation of aminoacids / carbohydrate by Thin Layer Chromatography.
2. Operation of HPLC (Demonstration)
3. Separation of nucleic acids and proteins by gel electrophoresis.



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M.Sc. (Microbiology / MLT) & PGDMLT		
Course Type	SEC		Version	2.0		
Semester	01		Effective From	June, 2026		
Course Code	MSMB23101	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
Master of Science (Microbiology) Sem-I and II

Name of faculty: Science	Department: Microbiology
Program: M.Sc. Microbiology Sem-I	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

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



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- 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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FACULTY OF SCIENCE
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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M. Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	02		Effective From	June, 2026		
Course Code	MSMB21201	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	50	50	100

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M. Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	02		Effective From	June, 2026		
Course Code	MSMB21202	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	0	2 hrs	50	50	100



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Master of Science (Microbiology) Sem-I and II

Name of Faculty: Sciences	Department: Microbiology
Program: M.Sc. Microbiology Sem-2	Type: DSC-5
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 be 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). Chapter1 Clean Room Technology. Retrieved from https://www.researchgate.net/publication/337561543_Chapter1_Clean_Room_Technology

Unit 1: Quality Assurance & GMP

(6 Hours)

- 1.1 The basics of pharmaceutical sector
- 1.2 Role of the microbiologist
- 1.3 Definition: Quality, Manufacture, Quality assurance (QA), Good manufacturing practice (GMP), Quality control (QC), In - process control, Validation. (Hugo & Russell)
- 1.4 What is cGMP?
- 1.5 Importance of cGMP
- 1.6 Key aspects of GMP compliance & Ten rules of GMP
- 1.7 The role and development of pharmacopoeias
- 1.8 Manufacture of sterile product: Design of premises & Aseptic areas



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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 pharmacopieas
- 3.2 Antibiotic susceptibility testing

Unit 4: Microbiological testing in pharmaceuticals -2

(8 Hours)

- 4.1 Endotoxin and Pyrogen testing
 - 4.4.1 Introduction
 - 4.4.2 Pyrogenicity
 - 4.4.3 Bacterial endotoxin
 - 4.4.4 Quantifying endotoxin
 - 4.4.5 The limulus amebocyte lysate (LAL) test
 - 4.4.5.1 Gel clot method
 - 4.4.5.2 Turbidometric method
 - 4.4.5.3 Chromogenic method
 - 4.4.6 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
- 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



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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	M. Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	02		Effective From	June, 2026		
Course Code	MSMB21203	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	M. Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	02		Effective From	June, 2026		
Course Code	MSMB21204	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



SARVAJANIK UNIVERSITY
FACULTY OF SCIENCE
Master of Science (Microbiology) Sem-I and II

Name of faculty: Science	Department: Microbiology
Program: M.Sc. Microbiology Sem-2	Type: DSC-6
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.
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- 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.
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- 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	M. Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	2		Effective From	June, 2026		
Course Code	MSMB21205	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	M. Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	2		Effective From	June, 2026		
Course Code	MSMB21206	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: M.Sc. Microbiology Sem-2	Type: DSC-7
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



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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

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.



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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

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



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M. Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	02		Effective From	June, 2026		
Course Code	MSMB21207	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	M. Sc. Microbiology		
Course Type	DSC		Version	2.0		
Semester	02		Effective From	June, 2026		
Course Code	MSMB21208	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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FACULTY OF SCIENCE
Master of Science (Microbiology) Sem-I and II

Name of faculty: Science	Department: Microbiology
Program: M.Sc. Microbiology Sem-2	Type: DSC-8
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
- 1.3 Genomics and bacterial pathogenicity
- 1.4 Regulation of bacterial virulence factors



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- 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 259
 - 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
- 4.4 Typing methods
- 4.5 Molecular epidemiology



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- 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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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M. Sc. Microbiology		
Course Type	DSE		Version	2.0		
Semester	02		Effective From	June, 2026		
Course Code	MSMB22201	Course Name	Epidemiology(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	M. Sc. Microbiology		
Course Type	DSE		Version	2.0		
Semester	02		Effective From	June, 2026		
Course Code	MSMB22202	Course Name	Epidemiology(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: Science	Department: Microbiology
Program: M.Sc. Microbiology Sem-2	Type: DSE-2
Subject: Epidemiology	
Credit: 04	Total learning hours: 45
Course description: The program focuses on fundamentals of epidemiology, specifically on disease surveillance in Public Health. The course helps to study of health and disease patterns in populations, and how to investigate their causes, distribution, and control. It provides trans-disciplinary research approach so to create and communicate knowledge on the causes and prevention of disease in the population health and health services. It also broadcasts the knowledge on usage of cutting-edge education and various research tools of public health.	
Student learning outcome: • To acquired concepts and principles of epidemiology • To provide intense knowledge of epidemiology-based health and diseases • To understand various epidemiologic methods • To acquire knowledge on Emergency Preparedness • To explain the concept of emergency risk communication practices	

Reference Book:

- Park and Park (2023). Text book preventive and social medicine. 27th Edition, Banarsidas Bhanot. ISBN-978-93-82219-19-4.
- Emergencies Preparedness. Communicating risk in public health emergencies: a WHO guideline for emergency risk communication (ERC) policy and practice. Who.int. World Health Organization; 2018.
Available from: <https://www.who.int/publications/i/item/9789241550208>
- Schneider, Mary- Jane (2013) Introduction to Public Health, 5th Edition. London: Jones and Bartlett. ISBN: 978-12-84046-35-9.
- Dicker R., Coronado F., Koo. D. and Parrish. R. G. (2012). Principles of Epidemiology in Public Health Practice., (3rd Edition). CDC.

Further Reading:

- Detel, Roger et al, Ed (2011). Oxford textbook of Public Health. 5th Edition. London. Oxford University Press. ISBN: 978-01-99218-70-7.
- Turnock, B.J. (2007). Essentials of Public Health. Jones & Bartlett, Publishers. ISBN: 978-07-63745-25-7

Unit-1: Principles of Epidemiology

(06 Hrs)

- 1.1 Aim of Epidemiology
- 1.2 Basic Measurements in Epidemiology
- 1.3 Measurements of Mortality
- 1.4 Measurements of Morbidity



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Unit-2: Epidemiologic Methods

(10 Hrs)

- 2.1 Epidemiologic Method: I: Observational Studies
 - 2.1.1 Descriptive Studies
 - 2.1.2 Analytical Studies: Case Control studies & Cohort studies
- 2.2 Epidemiologic Method: II: Experimental Studies
 - 2.2.1 Animal Studies
 - 2.2.2 Human Experiments
 - 2.2.3 Randomized Controlled Trials
- 2.3 Uses of Epidemiology

Unit-3: Concepts of Disease Occurrence

(07 Hrs)

- 3.1 Component causes and causal pies
- 3.2 Natural History and Spectrum of Disease
- 3.3 Chain of Infection
- 3.4 Implications for public health
- 3.5 Epidemic Disease Occurrence

Unit-4: Epidemiology of Communicable & Non communicable Diseases

(08 Hrs)

- 4.1 Epidemiology of Communicable Diseases
 - 4.1.1 Respiratory Diseases: Covid-19
 - 4.1.2 Intestinal Infections: Food Poisoning
 - 4.1.3 Arthropod- Borne Infections: Zika Virus Disease
- 4.2 Epidemiology of Non communicable Diseases
 - 4.2.1 Cardiovascular Diseases
 - 4.2.2 Diabetes mellitus
 - 4.2.3 Obesity

Unit-5: Emergency Preparedness

(06 Hrs)

- 5.1 Emergency Preparedness
- 5.2 Types of Disasters and Public Health Responses
- 5.3 New York's Response to the World Trade Center Attacks
- 5.4 Response to Hurricane Katrina
- 5.5 Principles of Emergency Planning and Preparedness
- 5.6 Bioterrorism Preparedness & Pandemic Flu

Unit-6: Emergency risk communication practice

(07 Hrs)

- 6.1 Strategic communication planning
- 6.2 Monitoring and evaluation tools
 - 6.2.1 Social media
 - 6.2.2 Messaging
- 6.3 Research priorities and gaps
- 6.4 Composition of guideline groups & its development

List of Practicals

- 1. Incidence & Prevalence and Measurement of risk
- 2. Steps of Investigation of an Epidemic: Case Study



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Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		Program	M.Sc.(Microbiology/MLT) & PGDMLT		
Course Type	SEC		Version	2.0		
Semester	02		Effective From	June, 2026		
Course Code	MSMB23201	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



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Name of faculty: Science	Department: Microbiology
Program: M.Sc. Microbiology Sem-2	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>



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