SARVAJANIK UNIVERSITY
INCLUSIVE | INTEGRATED | INNOVATIVE

SARVAJANIK UNIVERSITY
Dr. R.K. Desai Marg, Athwalines, Surat - 395001, Gujarat, India
Contact: 0261-2660266 / 9979102021 / 9712930321
Email: admin@sarvajanikuniversity.ac.in
info@sarvajanikuniversity.ac.in

Course Curriculum
BACHELOR OF SCIENCE (Hons.) BIOTECHNOLOGY Sem-5 and 6

The Course Curriculum of Bachelor of Science (Biotechnology) was proposed and drafted by **Academic and Curriculum Committee of Biotechnology** under the Faculty of Science in the meeting held on 22-07-2025 and recommended to **'BOARD OF STUDIES'** for approval.

Dr. Jay Bergi **Chairman, Academic** **& Curriculum Committee** **Science**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

The proposed Course Curriculum was approved by **Board of Studies; Science** under the Faculty of Science in the meeting held on 08-08-2025 and was recommended to the **'FACULTY'** for approval.

Dr. Chaulami Desai **Chairman,** **Board of Studies- Science**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

The Course Curriculum approved by the **Faculty of Science** in the meeting held on 08-08-2025 and was recommended to **'ACADEMIC COUNCIL'** for approval.

Dr. Chaulami Desai **Chairman & Dean,** **Faculty of Science**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

The Course Curriculum approved by the **'Academic Council of Sarvajanik University** 'in the meeting held on 22-08-2025.

Mr. Ashish Desai **Member Secretary,** **Academic Council** **& I/c. Registrar,** **Sarvajanik University**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

- ***The approved curriculum of Bachelor of Science (Hons.) Biotechnology is with effect from the Academic year 2025–26 and to be reviewed before 2028 –29***

SARVAJANIK UNIVERSITY
INCLUSIVE | INTEGRATED | INNOVATIVE

SARVAJANIK UNIVERSITY
Dr. R.K. Desai Marg, Athwalines, Surat - 395001, Gujarat, India
Contact: 0261-2660266 / 9979102021 / 9712930321
Email: admin@sarvajanikuniversity.ac.in
info@sarvajanikuniversity.ac.in

Course Curriculum
BACHELOR OF SCIENCE (Hons.) CHEMISTRY Sem-5 and 6

The Course Curriculum of Bachelor of Science (Chemistry) was proposed and drafted by **Academic and Curriculum Committee of Chemistry** under the Faculty of Science in the meeting held on 21-07-2025 and recommended to **'BOARD OF STUDIES'** for approval.

Dr. Chaulami Desai **Chairman, Academic** **& Curriculum Committee** **Science**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

The proposed Course Curriculum was approved by **Board of Studies; Science** under the Faculty of Science in the meeting held on 08-08-2025 and was recommended to the **'FACULTY'** for approval.

Dr. Chaulami Desai **Chairman,** **Board of Studies- Science**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

The Course Curriculum approved by the **Faculty of Science** in the meeting held on 08-08-2025 and was recommended to **'ACADEMIC COUNCIL'** for approval.

Dr. Chaulami Desai **Chairman & Dean,** **Faculty of Science**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

The Course Curriculum approved by the **'Academic Council of Sarvajanik University** 'in the meeting held on 22-08-2025.

Mr. Ashish Desai **Member Secretary,** **Academic Council** **& I/c. Registrar,** **Sarvajanik University**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

- ***The approved curriculum of Bachelor of Science (Hons.) Chemistry is with effect from the Academic year 2025–26 and to be reviewed before 2028 –29***

SARVAJANIK UNIVERSITY
INCLUSIVE | INTEGRATED | INNOVATIVE

SARVAJANIK UNIVERSITY
Dr. R.K. Desai Marg, Athwalines, Surat - 395001, Gujarat, India
Contact: 0261-2660266 / 9979102021 / 9712930321
Email: admin@sarvajanikuniversity.ac.in
info@sarvajanikuniversity.ac.in

Course Curriculum

BACHELOR OF SCIENCE (Hons.) ENVIRONMENTAL SCIENCE Sem-5 and 6

The Course Curriculum of Bachelor of Science (Environmental Science) was proposed and drafted by **Academic and Curriculum Committee of Environmental Science** under the Faculty of Science in the meeting held on 22-07-2025 and recommended to **'BOARD OF STUDIES'** for approval.

Dr. Ratna Trivedi **Chairman, Academic** **& Curriculum Committee** **Science**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

The proposed Course Curriculum was approved by **Board of Studies; Science** under the Faculty of Science in the meeting held on 08-08-2025 and was recommended to the **'FACULTY'** for approval.

Dr. Chaulami Desai **Chairman,** **Board of Studies- Science**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

The Course Curriculum approved by the **Faculty of Science** in the meeting held on 08-08-2025 and was recommended to **'ACADEMIC COUNCIL'** for approval.

Dr. Chaulami Desai **Chairman & Dean,** **Faculty of Science**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

The Course Curriculum approved by the **'Academic Council of Sarvajanik University** 'in the meeting held on 22-08-2025.

Mr. Ashish Desai **Member Secretary,** **Academic Council** **& I/c. Registrar,** **Sarvajanik University**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

- ***The approved curriculum of Bachelor of Science (Hons.) Environmental Science is with effect from the Academic year 2025–26 and to be reviewed before 2028 –29***

SARVAJANIK UNIVERSITY
INCLUSIVE | INTEGRATED | INNOVATIVE

SARVAJANIK UNIVERSITY
Dr. R.K. Desai Marg, Athwalines, Surat - 395001, Gujarat, India
Contact: 0261-2660266 / 9979102021 / 9712930321
Email: admin@sarvajanikuniversity.ac.in
info@sarvajanikuniversity.ac.in

Course Curriculum
BACHELOR OF SCIENCE (Hons.) MICROBIOLOGY Sem-5 and 6

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 21-07-2025 and recommended to **'BOARD OF STUDIES'** for approval.

Dr. Sanjay Parekh **Chairman, Academic** **& Curriculum Committee** **Science**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

The proposed Course Curriculum was approved by **Board of Studies; Science** under the Faculty of Science in the meeting held on 08-08-2025 and was recommended to the **'FACULTY'** for approval.

Dr. Chaulami Desai **Chairman,** **Board of Studies- Science**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

The Course Curriculum approved by the **Faculty of Science** in the meeting held on 08-08-2025 and was recommended to **'ACADEMIC COUNCIL'** for approval.

Dr. Chaulami Desai **Chairman & Dean,** **Faculty of Science**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

The Course Curriculum approved by the **'Academic Council of Sarvajanik University** 'in the meeting held on 22-08-2025.

Mr. Ashish Desai **Member Secretary,** **Academic Council** **& I/c. Registrar,** **Sarvajanik University**	**Place of the meeting** **Sarvajanik University Office**	**Sign**

- ***The approved curriculum of Bachelor of Science (Hons.) Microbiology is with effect from the Academic year 2025–26 and to be reviewed before 2028 –29***

CURRICULUM FOR

"BACHELOR OF SCIENCE (HONS.)"

B.Sc. (Hons.) Biotechnology
B.Sc. (Hons.) Chemistry
B.Sc. (Hons.) Environmental Science
B.Sc. (Hons.) Microbiology

SEM - 5

w.e.f. Academic Year 2025-26

॥ 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,
Surat-395001, Gujarat, India.
Website: www.sarvajanikuniversity.ac.in
Email: admin@sarvajanikuniversity.ac.in
Email: info@sarvajanikuniversity.ac.in
Mo.:+919979102021 / +9197129 30321
Contact No .+912612660266

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

Sarvjanik University
Faculty of Science
Exam Scheme for B.Sc. (Hons.) Environmental Science A.Y. 2025-26

Semester - V (2025-26)										
Sr No	Course Code	Group	Subjects	Credit	Hours / Week			CEE	SEE	Total
					Lecture	Practical	Total	Marks	Marks	Marks
1	BSES31530	Major	Atmosphere and Climate (TH)	3	3	-	3	40	35	75
	BSES31539		Atmosphere and Climate (PR)	1	-	1	2	10	15	25
	BSES31527		Environmental Biotechnology (TH)	3	3	-	3	40	35	75
	BSES31536		Environmental Biotechnology (PR)	1	-	1	2	10	15	25
	BSCH31529		Green Chemistry (TH)	3	3	-	3	40	35	75
	BSCH31538		Green Chemistry (PR)	1	-	1	2	10	15	25
2	BSES32515	Minor (ANY TWO)	Forest Management (TH)	3 + 3	3 + 3	-	3 + 3	40 + 40	35 + 35	75 + 75
	BSES32516		Ethnobotany (TH)							
	BSES32517		Industrial Safety and Managment (TH)							
	BSES32518		Industrial Safety and Accident Prevention (TH)							
	BSCH32519		Analytical Chemistry-II (TH)							
	BSCH32520		Analytical Techniques in Applied Sciences (TH)							
	BSCH32521		Forensic Chemistry (TH)							
	BSBT32522		Forensic Biology and Environmental Forensics (TH)							
	BSMB32523		Concept of Fermentation Technology (TH)							
	BSMB32524		Screening and Improvement of Microorganisms (TH)							
	BSMB32525		Introduction to Clinical Pathology and Histopathology (TH)							
	BSMB32526		Basics of Clinical Biochemistry (TH)							
	BSES32527		Forest Management (PR)	1 + 1	-	1 + 1	2 + 2	10 + 10	15 + 15	25 + 25
	BSES32528		Ethnobotany (PR)							
	BSES32529		Industrial Safety and Managment (PR)							
	BSES32530		Industrial Safety and Accident Prevention (PR)							
	BSCH32531		Analytical Chemistry-II (PR)							
	BSCH32532		Analytical Techniques in Applied Sciences (PR)							
	BSCH32533		Forensic Chemistry (PR)							
	BSBT32534		Forensic Biology and Environmental Forensics (PR)							
	BSMB32535		Concept of Fermentation Technology (PR)							
	BSMB32536		Screening and Improvement of Microorganisms (PR)							
	BSMB32537		Introduction to Clinical Pathology and Histopathology (PR)							
	BSMB32538		Basics of Clinical Biochemistry (PR)							
3	BSAS35508	SEC	2G Ethanol Plant Operator	2	2	-	2	25	25	50
	BSAS35509		Organic Grower							
		Total		**22**	**17**	**5**	**27**	**275**	**275**	**550**

Sarvjanik University
Faculty of Science
Exam Scheme for B.Sc. (Hons.) Microbiology A.Y. 2025-26

Semester - V (2025-26)										
Sr No	Course Code	Group	Subjects	Credit	Hours / Week			CEE	SEE	Total
					Lecture	Practical	Total	Marks	Marks	Marks
1	BSBT31528	Major	Molecular Biology (TH)	3	3	-	3	40	35	75
	BSBT31537		Molecular Biology (PR)	1	-	1	2	10	15	25
	BSMB31531		Basics of Immunology (TH)	3	3	-	3	40	35	75
	BSMB31540		Basics of Immunology (PR)	1	-	1	2	10	15	25
	BSMB31532		Industrial Microbiology (TH)	3	3	-	3	40	35	75
	BSMB31541		Industrial Microbiology (PR)	1	-	1	2	10	15	25
2	BSES32515	Minor (ANY TWO)	Forest Management (TH)	3 + 3	3 + 3	-	3 + 3	40 + 40	35 + 35	75 + 75
	BSES32516		Ethnobotany (TH)							
	BSES32517		Industrial Safety and Managment (TH)							
	BSES32518		Industrial Safety and Accident Prevention (TH)							
	BSCH32519		Analytical Chemistry-II (TH)							
	BSCH32520		Analytical Techniques in Applied Sciences (TH)							
	BSCH32521		Forensic Chemistry (TH)							
	BSBT32522		Forensic Biology and Environmental Forensics (TH)							
	BSMB32523		Concept of Fermentation Technology (TH)							
	BSMB32524		Screening and Improvement of Microorganisms (TH)							
	BSMB32525		Introduction to Clinical Pathology and Histopathology (TH)							
	BSMB32526		Basics of Clinical Biochemistry (TH)							
	BSES32527		Forest Management (PR)	1 + 1	-	1 + 1	2 + 2	10 + 10	15 + 15	25 + 25
	BSES32528		Ethnobotany (PR)							
	BSES32529		Industrial Safety and Managment (PR)							
	BSES32530		Industrial Safety and Accident Prevention (PR)							
	BSCH32531		Analytical Chemistry-II (PR)							
	BSCH32532		Analytical Techniques in Applied Sciences (PR)							
	BSCH32533		Forensic Chemistry (PR)							
	BSBT32534		Forensic Biology and Environmental Forensics (PR)							
	BSMB32535		Concept of Fermentation Technology (PR)							
	BSMB32536		Screening and Improvement of Microorganisms (PR)							
	BSMB32537		Introduction to Clinical Pathology and Histopathology (PR)							
	BSMB32538		Basics of Clinical Biochemistry (PR)							
3	BSAS35508	SEC	2G Ethanol Plant Operator	2	2	-	2	25	25	50
	BSAS35509		Organic Grower							
		Total		**22**	**17**	**5**	**27**	**275**	**275**	**550**

SARVAJANIK UNIVERSITY

INCLUSIVE | INTEGRATED | INNOVATIVE

MAJOR SUBJECTS

SEM 5

DETAILED CURRICULUM

(W.E.F. 2025-26)

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. BT		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSBT31526	**Course Name**	Animal Physiology and Immunology (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. BT		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSBT31535	**Course Name**	Animal Physiology and Immunology (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of faculty: Science	**Department:** Biotechnology
Program: B.Sc. Biotechnology	**Type:** Major
Subject: Animal Physiology and Immunology	**Semester:** 5
Credit: 03 + 01	

Course Description:

The paper imparts the fundamental aspects understanding in the fields of animal physiology, histology & anatomy as well as protective defence system mounted by the host against the foreign threat/invading harmful agents. Students will gain knowledge about the basics of reproduction. These will prepare students for further advanced research & learning. Also it encompasses various components and approaches employed by the host defence system to provide protective state – immunity against invading harmful agents-pathogens. It elucidates the abnormalities/diseases/disorders arising on account of immune malfunctioning. It also focuses on the applicative insight of the immune components in artificial immunity. It will provide a base for many entrance exams & summer internships.

Student Learning Outcome:

After completion of this course, student will…

1. Be informed about and memorise the fundamental knowledge of animal tissues, histology, anatomy, physiology & behaviour.
2. Understand basic information about anatomy, physiology and reproduction of humans.
3. Apply the basic concepts of physiology and reproduction to biotechnology.
4. Compare and analyse components of the immune system and their action to provide the protective state to the host system.
5. Evaluate treatments and control strategies of diseases using vaccines.
6. Create and infer outcomes of case studies where host immune system has some disorders.

Unit-1 Fundamentals of Animal Physiology (06 Hours)

1.1 Tissue and Organ Systems : Types of Animal Tissues , their Structure and Functions
1.2 Nervous System: Glial Cells, Synapses, Neurotransmitters
1.3 Endocrine System: Hormones and their Physiological Roles, Hormone Activity

Unit-2 Physiological Systems (08 Hours)

2.1 Cardiovascular System: Hemostasis
2.2 Musculoskeletal System: Sliding Filament theory
2.3 Reproductive System (only of humans): Human Male and Female Reproductive System, Female Reproductive Cycle

Unit–3 Advanced Physiological Processes (08 Hours)

3.1 Neurophysiology: Reflexes and Reflex Arcs, Electric Signals in Neurons, Signal Transmission at Synapses, Neural Circuits
3.2 Reproductive Physiology(of only humans) : Gametogenesis, Fertilization
3.3 Thermoregulation Adaptation : Body Temperature Homeostasis, Energy Homeostasis and Regulation of Food Intake

Unit–4 Introduction to Immunology and Immune System (08 Hours)

4.1 Overview of Host Resistance (Definition and Types of Immunity)
4.2 Cells, Tissues and Organs of the Immune System
4.3 Anatomical Barriers
4.4 Chemical Barriers
4.5 Inflammatory Barrier
4.6 Phagocytic Barrier

Unit–5 Specific Immunity (08 Hours)

5.1 Antigen
5.2 Antibody Structure and Classes
5.3 MHC Complexes
5.4 T cell Biology
5.5 B cell Biology
5.6 Antibody Functions

Unit–6 Immune System Disorders (07 Hours)

6.1 Hypersensitivities
6.2 Autoimmunity (IDDM, Rheumatoid Arthritis)
6.3 Immune Deficiency (Primary Immunodeficiency- SCID, Secondary Immunodeficiency- HIV and AIDS)

References & Text Books:

1. Ghai, C. L. A Textbook of Practical Physiology. JP Medical Ltd, ISBN: 978-93-5025-932-0
2. Hall. John. Hall Michael, Guyton & Hall A Textbook of Medical Physiology - ISBN: 978-0-323-59712-8
3. Tortora, Gerard J., and Bryan H. Derrickson. Principles of Anatomy and Physiology. John Wiley & Sons, ISBN-10: 1119400066
4. Janis Kuby, Kindst, Gatsby And Osborne, Kuby Immunology –, 6th Edition, W. H. Freeman Publications. ISBN-13-978-0716767640
5. Ashim Chakravarty, Immunology And Immunotechnology- Oxford University Press, ISBN-13: 978-0-19-567688-4
6. John P. Harley, Donald A. Klein, Microbiology- Lansing Prescott,, 10th Edition, Mcgraw Hill Publication. ISBN-13-978-1259281594
7. A. K Abbas, A. Lichtman, S. Pillai, Cellular and Molecular Immunology-, International Edition, ISBN: 978-1-4160-3122-2 International Edition ISBN: 978-0-8089-2358-9

Practicals:

1. To perform Mancini test (Radial Immunodiffusion assay).
2. To perform Differential Count from blood smear.
3. To study histological slides of tissues with the help of permanent slides.
4. To study EEG (electroencephalography) Electromyography (EMG) & Period-Ovulation Calculator

References & Text Books for Practical:

1. Experimental Microbiology by Rakesh Patel Vol: 2, Aditya Publications

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences				
Faculty	Science	**Program**	B.Sc. BT/ES	
Year	3	**Version**	3	
Semester	V	**Effective From**	July 2025	
Course Code	BSES31527	**Course Name**	Environmental Biotechnology (TH)	

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences				
Faculty	Science	**Program**	B.Sc. BT/ES	
Year	3	**Version**	3	
Semester	V	**Effective From**	July 2025	
Course Code	BSES31536	**Course Name**	Environmental Biotechnology (PR)	

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of Faculty: Science	**Department**: Environmental Science
Program: B.Sc. (Hons)	**Type:** Major
Subject: Environmental Biotechnology	**Semester:** 5
Credits: 03 + 01 = 04	
Course Description: This course gives an overview of biological solutions to the environmental issues like energy, pollution and chemical methods of agriculture.	
Student Learning Outcomes (SLOs): At the end of the course, students will be able to: 1. Define and Remember scope and interdisciplinary nature of environmental biotechnology. 2. Understand the Principles of Environmental Biotechnology. 3. Apply different bioremediation strategies, including microbial degradation and phytoremediation. 4. Compare traditional energy sources with alternatives in terms of sustainability and environmental impact. 5. Evaluate Applications of Bioenergy and Sustainable Technologies 6. Analyse the role of biofertilizers and biopesticides in sustainable agriculture. energy in waste recycling.	

Unit 1: Introduction to Environmental Biotechnology **(08 hrs)**

1.1 Definition, scope, and interdisciplinary nature
1.2 Microbes and enzymes in biotechnology
1.3 Concept of bio economy and green biotechnology
1.4 Sustainable Development Goals (SDGs) and biotech integration

Unit 2: Biofuels **(08 hrs)**

2.1 Biomass Electric Power Generation
2.2 Ethanol Production
2.3 Ethanol Production from Cellulosic Biomass
2.4 Ethanol from Starch Based Feedstock
2.5 Biodiesel
2.6 Hydrogenase-Dependant Hydrogen Production

Unit 3: Bioremediation **(07 hrs)**

3.1 Types of Bioremediation
3.2 *In situ* Bioremediation
3.3 Groundwater and Saturated Soil Remediation
3.4 Air Sparging
3.5 Overview of Phytoremediation

Unit 4: Biofertilizers and Biopesticides **(07 hrs)**

- 4.1 Biofertilizer Types
- 4.2 *Rhizobium, Azospirillum, Azotobacter* and Mycorrhiza
- 4.3 Classification of Pesticides
- 4.4 Types of Biopesticides
- 4.5 List of Biopesticides

Unit 5: Bioenergy, Climate Change, and Circular Economy **(08 hrs)**

- 5.1 Use of Biofuels for climate mitigation
- 5.2 Carbon footprint and carbon sequestration
- 5.3 Life Cycle Assessment (LCA) of biotech products
- 5.4 Circular economy and resource recovery models

Unit 6: Policy, Ethics, and Environmental Governance **(07 hrs)**

- 6.1 National Biotechnology Development Strategy (India)
- 6.2 Environmental laws and regulations related to biotech (Biosafety, EIA, GMO rules)
- 6.3 Ethical issues in biotechnology
- 6.4 Role of international institutions: UNEP, CBD, FAO, WTO (TRIPS & biotech patents)

Practicals:

1. Biosorption of Heavy Metals.
2. Phytoremediation of pollutants.
3. Isolation and study of *Azotobacter* from soil.
4. Cultivation of microbes on waste material and observation of decomposition rate and biomass generation.
5. Ethanol fermentation and detection of alcohol.

References:

1. Environmental Biotechnology by M. H. Fulekar ISBN: 978-1138097469
2. Dubey, R.C. (2016). *A Textbook of Biotechnology*, S. Chand.
3. Climate Change and Energy Options for a Sustainable Future (2021) by Dinesh Kumar Srivastava and V.S. Ramamurthy. ISBN 978-9811233470.
4. Bhattacharya, R.N. (2001). *Environmental Economics: An Indian Perspective*. Oxford University Press.
5. GoI (MoEFCC & CPCB). *Annual Reports, Environmental Policies, and Green Budget Documents*.
6. Rittmann, B.E., & McCarty, P.L. (2020). *Environmental Biotechnology: Principles and Applications*, McGraw-Hill.
7. Hanley, N., Shogren, J.F., & White, B. (2013). *Environmental Economics in Theory and Practice*, Macmillan.

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. BT/MB		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSBT31528	**Course Name**	Molecular Biology (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. BT		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSBT31537	**Course Name**	Molecular Biology (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of Faculty: Science	**Department**: Biotechnology
Program: B.Sc. (Hons)	**Type:** Major
Subject: Molecular Biology	**Semester:** 5
Credits: 03 + 01 = 04	
Course description: This course explains the molecular basis of life and tries to understand core processes involved with macromolecule synthesis and their regulation. It also explains generation of diversity in the genetic matter.	
Student Learning Outcomes (SLOs): At the end of the course, students will be able to: 1. Understand the Fundamental Concepts of Molecular Biology. 2. Explain the molecular basis of life, including DNA, RNA and protein structures and functions. 3. Describe key molecular processes such as DNA replication, transcription, and translation. 4. Compare different mechanisms of gene regulation. 5. Analyse and interpret experimental results in molecular biology research.	

UNIT 1: Nature of Genetic Material and DNA Replication **(08 hrs)**

1.1 DNA as genetic material
1.2 Central Dogma of molecular biology
1.3 DNA replication in Bacteria
- 1.3.1 Origin
- 1.3.2 Replication machinery
- 1.3.3 Events at replication fork
- 1.3.4 Termination of replication

Unit 2: Transcription in Bacteria **(06 hrs)**

2.1 Bacterial gene structure
2.2 Transcription in bacteria
- 2.2.1 Bacterial RNA polymerases
- 2.2.2 Stages of transcription

2.3 Genetic code

Unit 3: Translation in Bacteria **(08 hrs)**

3.1 Transfer RNA and Amino Acid Activation
3.2 Ribosome Structure
3.3 Initiation of Protein Synthesis
3.4 Elongation of Polypeptide Chain
3.5 Insertion of Celenocystein and Pyrrolysine
3.6 Termination of Protein Synthesis

Unit 4: Regulation of Bacterial Processes **(07 hrs)**

4.1 Levels of Regulation
4.2 Induction and Repression of Enzyme Synthesis
4.3 Regulatory Proteins
4.4 Lactose Operon: Negative Control
4.5 Tryptophan Operon: Negative Control

Unit 5: Mutations and Repair **(09 hrs)**

5.1 Spontaneous Mutations
5.2 Induced Mutations
5.3 Effect of Mutations
5.4 Mutant Detection
5.5 Mutant Selection
5.6 Mutagens and Carcinogens
5.7 Mismatch Repair

Unit 6: Enhancement in Genetic Variability **(07 hrs)**

6.1 Horizontal Gene Transfer
6.2 Molecular Recombination
6.3 Transposable Elements
6.4 Bacterial Conjugation: F^+ x F^- mating
6.5 Bacterial Transformation
6.6 Transduction

Practicals:

1. Study of UV mutagenesis in *Serratia marcescens*
2. Study of Gradient Plate Technique
3. Enumeration of DNA by Spectrophotometry
4. Electrophoretic Separation of DNA

References:

1. John P. Harley, Donald A. Klein, Microbiology- Lansing Prescott, 10th Edition, Mcgraw Hill Publication. ISBN-13-978-1259281594

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences				
Faculty	Science	**Program**	B.Sc. ES	
Year	3	**Version**	3	
Semester	V	**Effective From**	July 2025	
Course Code	BSES31530	**Course Name**	Atmosphere and Climate (TH)	

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences				
Faculty	Science	**Program**	B.Sc. ES	
Year	3	**Version**	3	
Semester	V	**Effective From**	July 2025	
Course Code	BSES31539	**Course Name**	Atmosphere and Climate (PR)	

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of Faculty: Science	**Department**: Environmental Science
Program: B.Sc. (Hons)	**Type:** Major
Subject: Atmosphere and Climate	**Semester:** 5
Credits: 03 + 01 = 04	

Course Description: To provide an in-depth understanding of atmospheric composition, structure, and processes.

1. To explore the mechanisms driving climate systems and variability.
2. To examine the impact of human activities on atmospheric changes and climate.
3. To introduce modern techniques for climate monitoring and atmospheric studies.
4. To develop analytical skills for interpreting climate models and mitigation strategies.

Student Learning Outcomes (SLOs):

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

1. Explain the composition and structure of the Earth's atmosphere.
2. Analyse weather patterns, atmospheric circulation, and climatic changes.
3. Evaluate the causes and consequences of climate change and global warming.
4. Apply methods for atmospheric data collection and climate modelling.
5. Assess the impact of anthropogenic activities on atmospheric processes.

Unit 1: Introduction to Atmospheric Science (7 Hours)

1.1 Composition and structure of the atmosphere.
1.2 Atmospheric layers and their characteristics.
1.3 Solar radiation and energy balance.
1.4 Greenhouse effect and its role in climate regulation.

Unit 2: Weather and Atmospheric Circulation (8 Hours)

2.1 Weather and climate: definitions and differences.
2.2 Atmospheric pressure systems and wind patterns.
2.3 Jet streams, monsoons, and oceanic circulation.
2.4 Cyclones, anticyclones, and extreme weather events.

Unit 3: Climate Classification and Variability (7 Hours)

3.1 Climate classification systems (Köppen and Thornthwaite).
3.2 Natural climate variability and oscillations (ENSO, NAO, IOD).
3.3 Palaeoclimatology: past climate changes and their evidence.
3.4 Role of forests and oceans in climate stabilisation.

Unit 4: Climate Change and Anthropogenic Impacts (7 Hours)

4.1 Causes of climate change: natural vs. anthropogenic.
4.2 Greenhouse gas emissions and their sources.
4.3 Impacts of climate change: sea level rise, melting glaciers, biodiversity loss.
4.4 Policies and global efforts to mitigate climate change (Kyoto Protocol, Paris Agreement).

Unit 5: Extreme Weather Events and Natural Disasters (8 Hours)

5.1 Types of extreme weather events (heatwaves, floods, droughts, hurricanes, tornadoes).
5.2 Causes and consequences of natural disasters.
5.3 Prediction and early warning systems.
5.4 Disaster preparedness and risk management.

Unit 6: Climate Modelling and Sustainable Management (8 Hours)

6.1 Climate models and their significance in prediction.
6.2 Remote sensing and satellite technology in climate studies.
6.3 Adaptation and mitigation strategies for climate resilience.
6.4 Sustainable development and policy frameworks for climate action.

Practical Components: (4 Practicals)

1. To Measurement of temperature, humidity, wind speed, and atmospheric pressure.
2. To study Climate Pattern Analysis using historical datasets.
3. Hands-on experience with climate simulation models and data visualization tools.
4. Analysis of past extreme weather events and their impact. (Extreme Weather Event Case Study)

Suggested References:

1. Wallace, J. M., & Hobbs, P. V. (2006). *Atmospheric Science: An Introductory Survey*. Academic Press.
2. Barry, R. G., & Chorley, R. J. (2010). *Atmosphere, Weather and Climate*. Routledge.
3. Peixoto, J. P., & Oort, A. H. (1992). *Physics of Climate*. Springer.
4. IPCC Reports (Intergovernmental Panel on Climate Change).
5. Ramanathan, V. (2001). *Atmospheric Brown Clouds and Climate Change*. Nature.

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences							
Faculty	Science			**Program**	B.Sc. MB		
Year	3			**Version**	3		
Semester	V			**Effective From**	July 2025		
Course Code	BSMB31531	**Course Name**	Basics of Immunology (TH)				
Teaching Scheme				**Examination Scheme**			
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**	
3	3	0	0	40	35	75	

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences							
Faculty	Science			**Program**	B.Sc. MB		
Year	3			**Version**	3		
Semester	V			**Effective From**	July 2025		
Course Code	BSMB31540	**Course Name**	Basics of Immunology (PR)				
Teaching Scheme				**Examination Scheme**			
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**	
1	0	0	1	10	15	25	

Name of faculty: Science	**Department:** Microbiology
Program: B.Sc. (Hons)	**Type:** Major
Subject: Basics of Immunology	
Credit: 04	**Total learning hours:** 45 Hours
Course description: The Basics of Immunology course has been designed to inclined students towards various host defence mechanisms helps to resist infectious conditions. It also helps to understand immune system development viz T cell and B cell significance. This course also enlightened students for immune response strategies. Further, knowledge of Ag-Ab reactions will help the students to know and corelate about fundamentals of diagnosis as well immunization mechanisms. Understanding of autoimmunity and its related disorders, helps student to immune system related health issues.	
Student learning outcome: At the end of this course, the students will understand the basics of immunology and inclined towards, • How host defense system is working and what are the various natural barriers that helps to resist infections • Cells, tissues and organs of immune system and various types of immunity • What are antigens and antibodies and how their effectiveness persists • Significant Immunological reactions and disorders associated to it	

Reference Books:

- Wiley, J.,& Sherwood, L. (2014). Prescott, Harley, and Klein's Microbiology, 9th Ed., McGraw-Hill Science/Engineering/Math.
- Pelczar, Chan and Krieg, (1993), Microbiology-Concepts and Application, 5th Ed., International Edition, McGraw-Hill
- Janis Kuby, Kindst, Gatsby And Osborne, Kuby Immunology –, 6th Edition, W. H. Freeman Publications. ISBN-13-978-0716767640

Further Reading:

- Ashim Chakravarty, Immunology and Immunotechnology - Oxford University Press, ISBN-13: 978-0-19-567688-4
- John P. Harley, Donald A. Klein, Microbiology- Lansing Prescott, 10th Edition, Mcgraw Hill Publication. ISBN-13-978-1259281594
- A. K Abbas, A. Lichtman, S. Pillai, Cellular and Molecular Immunology-, International Edition, ISBN: 978-1-4160-3122-2 International Edition ISBN: 978-0- 8089-2358-9

Unit-1: Host Defenses **(Duration: 08 Hrs)**

1.1 Innate Resistance Overview
1.2 Physical and Mechanical Barrier Defenses of Innate Resistance- I: Skin, Mucous membrane, Lysosyme
1.3 Physical and Mechanical Barrier Defenses of Innate Resistance-II: Respiratory system, Gastrointestinal Tract, Genitourinary Tract
1.4 Chemical Mediators in Innate Resistance
1.5 Complement system

Unit-2: Cells, Tissues, and Organs of the Immune System **(Duration: 06 Hrs)**

2.1 Cells of Immune system
2.2 Organs and Tissues of the Immune System
  2.2.1 Primary Lymphoid Organs and Tissues
  2.2.2 Secondary Lymphoid Organs and Tissues

Unit-3: Types of Adaptive Immunity & Recognition of Foreignness (Duration: 07 Hrs)
3.1 Overview of Adaptive Immunity
3.2 Types of Adaptive Immunity
3.3 The Major Histocompatibility Complex
3.4 Cluster of Differentiation Molecules

Unit-4: T Cell & B Cell Biology **(Duration: 09 Hrs)**

4.1 T-Cell Biology
  4.1.1 T-Cell Receptors
  4.1.2 T-Cell Activation
  4.1.3 T cells Types
4.2 Superantigens
4.3 B-Cell Biology

Unit:5 Antigens & Antibodies **(Duration: 07 Hrs)**

5.1 Antigen
5.2 Haptens
5.3 Antibodies: Immunoglobulin Structure
5.4 Immunoglobulin Functions
5.5 Immunoglobulin Classes

Unit 6 Immunological reactions & Immunological Disorders **(Duration: 08 Hrs)**

6.1 Assay and Applications of the Immune response
  6.1.1 Precipitation
  6.1.2 Immunoelectrophoresis
  6.1.3 Agglutination tests
  6.1.4. Complement fixation tests
  6.1.5 RIA
  6.1.6 ELISA
6.2 Hypersensitivity reactions
6.3 Autoimmunity and Autoimmune Diseases

List of Practicals

1. Total count of WBC & RBC
2. Determination of Differential count of blood cells.
3. Determination of blood groups: ABO and Rh Grouping (Slide method)
4. Screening test for Syphilis by RPR test – Qualitative
5. Diagnosis of Typhoid infection by Widal test – Dreyer's Double Dilution
6. Detection of HIV / Hepatitis (HBs Ag): Dot immunoassay
7. Detection of Rheumatoid arthritis by Latex test

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. MB		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSMB31532	**Course Name**	Industrial Microbiology (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. MB		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSMB31541	**Course Name**	Industrial Microbiology (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Industrial Microbiology

Name of Faculty: Sciences	**Department:** Microbiology
Program: B.Sc. (Hons) Sem 5	**Type:** Major
Subject: Industrial Microbiology	
Credit: 4	**Duration:** 45 hours

Course Description: This subject provides an understanding of how microbiology is applied in the industrial production of microbial products, focussing on the study of isolation, screening, and optimization of microbial strains. Students will gain insights into fermentation systems, media formulation, and sterility protocols essential for large-scale microbial production. The course emphasizes downstream processing for product recovery and microbial production of valuable bioproducts. Through a blend of theoretical knowledge and practical approaches, students will learn various aspects of industrial microbiology and bioprocessing.

Learning Outcomes:
By the end of this course, students will be able to:

- Understand screening techniques for isolating industrially important microorganisms.
- Describe the characteristics, and improvement of industrial strains and to analyse the role of media components and their impact on optimizing production.
- Explain the design, construction, and operation of fermentation systems.
- Apply sterilization techniques for media, air, and equipment to ensure sterility in industrial production processes.
- Outline and perform various techniques for recovering products from fermentation processes.
- Demonstrate knowledge of microbial fermentation for producing commercially important microbial metabolites.

Reference Book:

1. Crueger, W., Crueger, A., (2017). Crueger's Biotechnology: A textbook of Industrial Microbiology, 3rd Ed.., Medtech publisher.
2. Okafor N., (2007). Modern Industrial Microbiology and Biotechnology, Science Publishers. ISBN: 9781138036147.
3. Patel, A. H., (2016). Industrial Microbiology, 2nd Ed., Trinity press; An Imprint of Laxmi Publications PVT. Ltd. ISBN: 9789385750267.
4. Wiley, J., Sherwood, L., & Woolverton, C., (2017). Prescott's Microbiology, 10th edition. McGraw-Hill Education. ISBN: 978-1-259-28159-4.
5. Richard K.M. & Durbin S.R., (2020). Fermentation and Biochemical Engineering, Vol 1, CBS Publishers & Distributors Pvt Ltd. ISBN: 9789389185911.
6. Shivkumar P. K., Joe M. M., Sukesh K., (2010). An Introduction to Industrial Microbiology, S Chand Publishers. ISBN: 9788121935197.
7. Stanbury, P.F., (2006). Principles of Fermentation Technology, 2nd Ed., Elsevier Science Ltd. ISBN: 9780750645010.
8. Waites, M.J., et al., (2001). Industrial Microbiology: An Introduction, 1st Ed., Blackwell Publishing. ISBN: 9780632053070.

Unit 1: Isolation and Screening of Industrial Strains (6 Hours)

1.1 Isolation of microorganisms from the environment
1.2 Culture collections
1.3 Screening techniques
1.4 Inoculum development

Unit 2: Industrial Strains and Fermentation Media **(7 Hours)**

- **2.1** Ideal characteristics of industrial strains
- **2.2** Strain improvement
- **2.3** Strain stability
- **2.4** Fermentation media

Unit 3: Fermentation Systems **(8 Hours)**

- **3.1** Basic functions of a fermenter
- **3.2** Fermenter design and construction
- **3.3** Types of bioreactors
- **3.4** Solid-state and submerged fermentation

Unit 4: Industrial Sterilization **(8 Hours)**

- **4.1** Methods of achieving sterility: Physical and chemical methods
- **4.2** Aspects of sterilization in industry
  - **4.2.1** Sterilization of fermenter and its accessories
  - **4.2.2** Sterilization of production media
  - **4.2.3** Sterilization of air

Unit 5: Downstream Processing **(8 Hours)**

- **5.1** Outline of downstream processing operations
- **5.2** Cell harvesting
- **5.3** Cell disruption
- **5.4** Product recovery
- **5.5** Distillation and Finishing steps
- **5.6** Product development, regulation, and safety

Unit 6: Microbial Fermentation of Commercially Important Products **(8 Hours)**

- **6.1** Enzyme- Amylase
- **6.2** Antibiotic- Penicillin
- **6.3** Alcoholic beverages-Beer & Wine
- **6.4** Organic acids- Citric acid
- **6.5** Vitamin- Vitamin B_{12}

List of Practical

1) Screening of antibiotic, enzyme, and organic acid producers.
2) Sterility testing of pharmaceutical product by direct inoculation method.
3) Fermentative production of amylase enzyme by submerged fermentation and its estimation.
4) Separation of amino acids by paper chromatography.
5) Bioassay of penicillin.

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSCH31533	**Course Name**	Inorganic Chemistry-II (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSCH31542	**Course Name**	Inorganic Chemistry-II (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Department: Chemistry	
Program: B.Sc.	**Type:** Theory + Practical (NEP-2020-NEW)
Subject: Major: Inorganic Chemistry-II	**Semester:** 5
Credit: (3T + 1P)	**Total learning hours**: (45 T + 30 P) Hrs
Course description: This course provides an overview of d and f-block elements, many important aspects of coordination compounds, inorganic polymers, non-aqueous solvents. Course comprises of information about coordination compounds and organometallic compounds as well as basics of cages and metal clusters.	
Student learning outcome: Upon completion of this course, students will: **1.** Have a deep knowledge regarding lanthanide and actinide elements **2.** Be able to understand various theories related to coordination compounds **3.** Have systematic understanding organometallic compounds **4.** Get an idea regarding inorganic cages and metal clusters **5.** Be familiar with solvent other than water	

Unit-1 Coordination chemistry-II **(10 Hrs)**

1.1 Elementary crystal field theory: splitting of d^n configurations in octahedral, square planar and tetrahedral fields

1.2 Crystal field stabilization energy (CFSE) in weak and strong fields, pairing energy

1.3 Jahn- Teller distortion

1.4 Metal-ligand bonding (MO concept, elementary idea)

Unit-2 Organometallic compounds-II **(10 Hrs)**

2.1 Metal alkyls: important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer)

2.2 Concept of multicentre bonding in these compounds

2.3 Ferrocene: Preparation, physical properties and reactions (acetylation, alkylation, metallation, Mannich Condensation

2.4 Comparison of aromaticity of ferrocene and reactivity with that of benzene

Unit-3 Chemistry of d- and f- block elements **(10 Hrs)**

3.1 Transition elements

3.1.1 General composition of 3d, 4d and 5d elements in terms of electronic configuration, oxidation states, redox properties, coordination chemistry

3.2 Lanthanides and actinides

3.2.1 General comparison on electronic configuration, oxidation states, colour, spectral and magnetic properties; lanthanide contraction, separation of lanthanides (ion-exchange method only)

Unit-4 Non-aqueous solvents **(05 Hrs)**

4.1 Classification of solvents

4.2 Physical properties of a solvent for functioning as an effective reaction medium

4.3 General characteristics of solvents

4.4 Study of solvents such as liquid NH_3, liquid SO_2 and DMSO

Unit-5 Inorganic polymers **(05 Hrs)**

5.1 Overview of polymers

5.2 Types of inorganic polymers

5.3 Comparison with organic polymers

5.4 Synthesis, structural aspects and applications - silicones and siloxanes, borazines, phosphazenes, polysulphates

Unit-6 Cages and metal clusters **(05 Hrs)**

6.1 Cages

6.2 Boron cage compounds

6.3 Metal clusters: Metal-metal bonds

6.4 Synthesis of metal clusters

6.5 Types of clusters viz. carbonyl clusters, Halide type clusters, Boron clusters and their applications

Laboratory practical **(30 Hrs)**

Qualitative inorganic analysis: (Minimum four)

Analysis of mixture salt containing two anions and two cations (From two different groups) from the following:

Anions: Carbonate, Sulphate, Chloride, Bromide, Nitrate, Borate, Phosphate

Cations: Copper, Iron, Aluminum, Zinc, Manganese, Calcium, Strontium, Barium, Potassium and Ammonium.

Reference books:

Theory references:

1. Advanced Inorganic Chemistry, Satya Prakash Tuli, Basu & Madan 6th Edn,2000, S. Chand and Company Limited.
2. Calculation of Analytical Chemistry, Hamilton, Simpson &Ellis 7th Edn., 1969, ACS publication
3. Theoretical Inorganic Chemistry, Day, M.C. and Selbin, J., 2008, East-West Press
4. Concise Inorganic Chemistry, Lee J. D., Wiley India, 5th Edn., 2008, Oxford University Press
5. Inorganic Chemistry – Principles of structure and reactivity, Huheey J. E., Keiter E. A. and Keiter R. L., 4th Edn., 1997, Pearson
6. Principles of Inorganic Chemistry by Puri, Sharma, Kalia 33rd Edn.,2020, Vishal Publishing Co.
7. Selected Topic in Inorganic Chemistry, Malik, Tuli, Madan, 17th Edn., 2010, S. Chand
8. Basic Inorganic Chemistry, Cotton and Wilkinson, 3rd Edn., 1994, A John Wiley and Sons
9. Inorganic and organometalic polymers, Ranald D. Archer, 2001 A John Wiley and Sons, Inc. publication (USA)

Laboratory references

1. A Text Book on Chemistry Practical; 1st Edition, Bidhan Chandra Ray, Satyanarayan Das, Reprint 2017, NCBA.
2. Quantitative Inorganic Analysis, A.I Vogal, 5th Edn., 1989, Longman scientific and technical Publication

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSCH31534	**Course Name**	Physical Chemistry-II (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSCH31543	**Course Name**	Physical Chemistry-II (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Department: Chemistry	
Program: B.Sc.	**Type:** Theory + Practical (NEP-2020-NEW)
Subject: Major: Physical Chemistry-II: Chemical equilibrium and electrochemistry	**Semester:** 5
Credit: (3T + 1P)	**Total learning hours:** (45 T + 30 P) Hrs
Course description: This Course Paper proposes to teach about: The chemical equilibrium, hydrolysis, pH metric titrations, electrolytes and electrolysis, behaviour of ions in aqueous solutions, conductance and conductometric titrations..characteristics of above all and their applications.	
Student learning outcome: After completing this course, the students will be able to learn: Concepts and characteristics, various laws, principles, rules, derivations, measurements, determinations, and calculations related to chemical equilibrium, hydrolysis, pH metric titrations, electrolytes and electrolysis, behaviour of ions in aqueous solutions, conductance and conductometric titrations.	

Unit 1: Chemical equilibrium **(05 Hrs)**

1.1 Concepts and characteristics
1.2 The law of chemical equilibrium
1.3 The Le Chatelier's principle
1.3.1 Effects of change of temperature, pressure and concentration
1.4 Applications of the law of chemical equilibrium
1.5 Numericals

Unit 2: Hydrolysis **(06 Hrs)**

2.1 Hydrolysis, salt hydrolysis, hydrolysis constants
2.2 Relation between degree of hydrolysis
2.3 Hydrolysis constant and pH of solutions of
(a) Salts of weak acid and strong base
(b) Salts of strong acid and weak base
(c) Salts of weak acid and weak base
2.4 Significance of the Henderson-Hasselback equation
2.5 Numericals

Unit 3: Electrochemistry **(04 Hrs)**

3.1 Principle: Faraday's law
3.2 Electrochemical cell
3.3 Electrode Potential: Nernst's equation
3.4 Potentiometric titrations
3.5 Numericals

Unit 4:pH metric titrations **(06 Hrs)**

4.1 Principle of pH measurements
4.2 Acid-base titration curves
4.2.1 pH curve for a strong acid –strong base titrations
4.2.2 pH curve for a weak acid –strong base titrations
4.3.3 pH curve for a strong acid –weak base titrations
4.4 Numericals

Unit 5: Electrolytes **(12 Hrs)**

5.1 Ionic, metallic, electrolytic conduction
5.2 Classification of electrolytes
5.3 Electrolysis: Product formation of electrolysis
5.4 Migration of ions: Hittorf's rule
5.5 Kohlraush law of ionic conductance and its application
5.6 Numericals

Unit 6: Electrolytic conductance **(12 Hrs)**

6.1 Electrical conductance, specific conductance, equivalent conductance, molar conductance
6.2 Cell constant, Determination of Cell constant
6.3 Effect of dilution on concentration- Ostwald's dilution law and its limitations
6.4 Principle and types of conductometric titrations:
(a) strong acid v/s strong base (b) strong acid v/s weak base
(c) weak acid v/s strong base (d) weak acid v/s weak base
(e) weak acid and strong base mixture v/s strong base
6.5 Numericals

Laboratory practical (Any four): **(30 Hrs)**

1. Determination of cell constant and calibration of conductivity meter.
2. Determination of the normality and amount of the strong acid solution by conductometric titration against strong base solution.
3. Determination of the normality and amount of the acids (mixture of strong and weak acid) solution by conductometric titration against strong base solution.
4. Determination of the solubility and solubility product of sparingly soluble salt $PbSO_4$ By conductivity measurements.
5. Preparation of buffer solutions of different pH and standardization of pH meter.
6. Determination of the normality and amount of the strong acid solution by pH metric titration against strong base solution.
7. Determination of the normality and amount of the acids (mixture of strong and weak acid) solution by pH metric titration against strong base solution.
8. Potentiometric titration to find the strength of HCl solution against NaOH.
9. Determination of formal reduction potential of ferrous-ferric system and concentration of Fe^{+2} by potentiometer.

Reference books:

Theory references:

1. Arun Bahl, B.S. Bahi, G.D. Tuli; Essentials of Physical Chemistry; 1st Revised Edition (2008), Reprint (2016), S. Chand and Company Limited.
2. Ishwar Das, Archana Sharma, Namita Rani Agrawal, An Introduction to Physical Chemistry; 3rd Revised Edition, (2012), New Age International Publishers.
3. Text book of Engineering Chemistry by Shashi Chawla, Dhanpat Rai and Company, 3 rd Edition, (2003).
4. M.V. Sangaranarayanan, V. Mahadevan, Textbook of Physical Chemistry, 1st Edition, 2011, University Press (India) Pvt. Ltd.

5. Physical Chemistry for S.Y.B.Sc. Sem-4 by Dr. Hemangi Desai, New Popular Prakashan, (2017).
6. Samuel Glasstone, David Lewis, Elements of Physical Chemistry; 2nd Edition, (1960), The MacMillan Company of India Ltd.
7. A. S. Negi & S.C. Anand,A Text Book of Physical Chemistry by; 1st Edition, (1999), New Age International.
8. P. L. Soni and O. P. Dharmraj, Text Book of Physical Chemistry; 19th Edition, (1992), S. Chand and Company.
9. S.C.Khetarpal and Yogeshwar Sharma, Text book of Physical Chemistry; 1st Edition, (2001), R-Chand and Company.

Laboratory references:

1. J.B. Yadav, Advanced Physical Chemistry; 14th Edition, 1995, Goel Publishing House.
2. S.K.Bhasin, Sudha Rani, Laboratory Manual on Engineering Chemistry;3rd Edition, 2011, Dhanpatrai Publishing Company.
3. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York (2003).
4. Bidhan Chandra Ray, Satyanarayan Das, A Text Book on Chemistry Practical; 1st Edition, Reprint (2017), NCBA.

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences							
Faculty	Science			**Program**	B.Sc. ES/CHE		
Year	3			**Version**	3		
Semester	V			**Effective From**	July 2025		
Course Code	BSCH31529	**Course Name**	Green Chemistry (TH)				
Teaching Scheme				**Examination Scheme**			
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**	
3	3	0	0	40	35	75	

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences							
Faculty	Science			**Program**	B.Sc. ES / CH		
Year	3			**Version**	3		
Semester	V			**Effective From**	July 2025		
Course Code	BSCH31538	**Course Name**	Green Chemistry (PR)				
Teaching Scheme				**Examination Scheme**			
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**	
1	0	0	1	10	15	25	

Department: Chemistry	
Program: B.Sc.	**Type:** Theory + Practical (NEP-2020-NEW)
Subject: Major: Green Chemistry	**Semester:** 5
Credit: (3T + 1P)	**Total learning hours**: (45 T + 30 P) Hrs
Course description: This course introduces the principles and practices of Green Chemistry, focusing on sustainable chemical processes that minimize waste and environmental impact. The course covers green solvents, atom economy, renewable feedstock, catalysis, and pollution prevention techniques. Practical sessions are designed to apply these principles to real-world scenarios, equipping students with eco-friendly laboratory skills.	
Student learning outcome: 1. Understand the fundamental principles of Green Chemistry and their relevance to environmental sustainability. 2. Evaluate and apply green chemical methodologies for reducing waste and improving energy efficiency. 3. Gain expertise in renewable resources, green solvents, and catalysis for industrial applications. 4. Develop practical skills in eco-friendly laboratory techniques.	

Unit 1: Introduction to green chemistry **(08 Hrs)**

1.1 Definition and Principles of Green Chemistry
1.2 Overview and 12 Principles (Anastas & Warner)
1.3 Historical Development and Early Environmental Concerns
1.4 Emergence and Importance of Sustainable Chemistry

Unit 2: Green solvents and green reactions **(08 Hrs)**

2.1 Types of Green Solvents: Ionic Liquids, Supercritical Fluids, Water, Bio-Solvents
2.2 Properties and Advantages of Green Solvents
2.3 Solvent-Free Reactions and Mechanisms
2.4 Supercritical Fluids in Green Chemistry (e.g., CO_2)
2.5 Microwave-Assisted Synthesis

Unit 3: Atom economy and waste minimization **(07 Hrs)**

3.1 Concept and Importance of Atom Economy
3.2 Molecular Efficiency: Atom Efficiency vs. Reaction Efficiency
3.3 Waste Minimization in Synthetic Processes
3.4 Sustainable Production Pathways and By-Product Management
3.5 Case Studies: Pharmaceuticals, Agrochemicals, Fine Chemicals

Unit 4: Renewable resources and sustainable feedstocks **(07 Hrs)**

4.1 Biomass as a Feedstock: Plant Oils, Biopolymers, and Others
4.2 Conversion Processes: Biorefinery, Fermentation, Enzymatic Reactions
4.3 Biofuels: Types (Ethanol, Biodiesel) and Production Approaches
4.4 Green Catalysis in Feedstock Conversion

Unit 5: Green catalysis **07 Hrs)**

5.1 Introduction to Catalysis and Its Role in Green Chemistry
5.2 Types: Homogeneous, Heterogeneous, Enzymatic Catalysis
5.3 Principles of Green Catalysis: Non-Toxic, Reusable, and Efficient Catalysts
5.4 Industrial Applications: Pharmaceuticals, Petrochemicals, Polymerization

Unit 6: Green chemistry in environmental protection **(08 Hrs)**

6.1 Pollution Prevention Techniques
6.2 Green Chemistry in Air, Water, and Soil Pollution Control
6.3 Treatment of Industrial Effluents Using Green Methods
6.4 Sustainable Materials and Green Polymers: Biodegradable Polymers

---

Laboratory practical **(30 Hrs)**

Perform the following experiments (Any four):

1. Synthesis of Aspirin Using Green Chemistry Principles
   Objective: Prepare aspirin through an eco-friendly method minimizing waste.
2. Preparation of Biodiesel from Vegetable Oil
   Objective: Produce biodiesel using transesterification of vegetable oil.
3. Microwave-Assisted Synthesis of Benzimidazole
   Objective: Utilize microwave heating to synthesize Benzimidazole efficiently.
4. Diels-Alder Reaction Using Water as Solvent
   Objective: Perform a solvent-free or water-assisted Diels-Alder reaction.
5. Extraction of Essential Oils Using Steam Distillation
   Objective: Extract natural essential oils sustainably.

Reference books:

Theory references:

1. "Green Chemistry: Theory and Practice" by Paul T. Anastas and John C. Warner
2. "Introduction to Green Chemistry" by Albert Matlack
3. "Green Chemistry and Catalysis" by Roger A. Sheldon et al.
4. "Principles of Sustainable Chemistry" by Stanley E. Manahan
5. "Handbook of Green Chemistry" by Paul T. Anastas
6. "Green Chemistry: Environmentally Benign Reactions" by V. K. Ahluwalia
7. "Environmental Chemistry" by A. K. De
8. "Green Chemistry: A Textbook" by V. K. Ahluwalia and M. Kidwai
9. "Microwave-Assisted Organic Synthesis" by V. K. Ahluwalia and R. S. Varma
10. "Green Chemistry: An Introductory Text" by V. Kumar
11. "Biofuels: Green Energy and Technology" by N. Kishore and A. Pandey
12. "Advances in Biorefineries" edited by K. Waldron
13. "Catalysis and Green Chemistry" by R. A. Sheldon and K. Pandey
14. "Enzyme Technology" by Ashok Pandey
15. "Environmental Chemistry" by B. K. Sharma
16. "Pollution Control in Process Industries" by S. P. Mahajan

Laboratory references:

1. Laboratory Manual of Green Chemistry" by S.K. Sharma
2. Practical Green Chemistry" by Rashmi Sanghi and M.M. Srivastava
3. Experiments in Green Chemistry" by V.K. Ahluwalia and M. Kidwai
4. Green Chemistry Laboratory Manual for Undergraduate Students" by D. Venkateswarlu
5. Green Chemistry: Environmentally Benign Reactions" by V.K. Ahluwalia
6. Practical Organic Chemistry" by A.I. Vogel
7. Biofuels: Green Energy and Technology" by N. Kishore and A. Pandey
8. Introduction to Biofuels" by David M. Mousdale
9. Microwave-Assisted Organic Synthesis" by V.K. Ahluwalia and R.S. Varma
10. Organic Synthesis in the Laboratory" by Richard C. Larock
11. Advanced Organic Chemistry: Reactions, Mechanisms, and Structure" by Jerry March
12. Organic Reactions and Mechanisms" by P.S. Kalsi
13. Essential Oils: Extraction, Applications, and Benefits" by S.C. Saha
14. Practical Manual of Medicinal Plants" by S.K. Sharma

SARVAJANIK UNIVERSITY

INCLUSIVE | INTEGRATED | INNOVATIVE

MINOR SUBJECTS

SEM 5

DETAILED CURRICULUM

(W.E.F. 2025-26)

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSCH32519	**Course Name**	Analytical chemistry-II (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSCH32531	**Course Name**	Analytical Chemistry-II (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Unit 1: Sampling techniques **(05 Hrs)**

Department: Chemistry	
Program: B.Sc.	**Type:** Theory + Practical (NEP-2020-NEW)
Subject: Minor: Analytical Chemistry - II	**Semester:** 5
Credit: (3T + 1P)	**Total learning hours:** (45 T + 30 P) Hrs

Course description:
This course paper proposes to teach about: Sample collection from different sources, preservation techniques, Preparation of standard solutions, principle, reaction mechanism, analysis procedure and applications of volumetric titrations.

Student learning outcome:
After completing this course, the students will be able to learn:
Types and objectives of sampling techniques, preservation and pre concentration of collected samples, preparation of primary and secondary standards and their standardization methods, buffer solution and buffer capacity, indicators, principle, reaction mechanism, procedure of analysis methods and applications of acid-base titrations, precipitation titrations, complexometric titrations, redox titrations.

1.1 Objectives and types of Sampling
1.2 Sample Collection: Air, Water, Solids, Soil
1.3 Preservation Techniques of Samples
1.4 Preconcentration Techniques

Unit 2: Standard solutions **(08 Hrs)**
2.1 Primary and secondary Standards
2.2 Standardization of H_2SO_4 and NaOH
2.3 Standardization of $KMnO_4$ and I_2
2.4 Standardization of $Na_2S_2O_3$ and FAS

Unit 3: Acid-Base: Neutralization titrations **(08 Hrs)**
3.1 Concepts of Acid and Base
3.2 Types and actions of buffer solution and buffer capacity
3.3 Principle, Reaction Mechanism and Procedure of Analysis Method
3.4 Acid-Base Indicators: pH range, pH curves and indicator range,
3.5 Choice of a suitable indicator for various types of Acid-Base titrations

Unit 4: Precipitation titrations **(08 Hrs)**
4.1 Principle, Reaction Mechanism and Procedure of Analysis Method
4.1.1 Volhard Method
4.1.2 Mohr's Method
4.1.3 Fajan's Method
4.2 Indicators used in Precipitation Titrations

Unit 5: Complexometric titrations **(08 Hrs)**
5.1 Co-ordination number and complex formation
5.2 EDTA and the complexones –Ligand, Chelation
5.3 Principle, Reaction Mechanism and Procedure of Analysis Method
5.4 Indicators used in Complexometric Titrations
5.5 pH Control of the medium, Oxidation number adjustment of the metal ion
5.6 Advantages

Unit 6: Redox titrations **(08 Hrs)**
6.1 Principle of Oxidation -Reduction

6.2 Reaction Mechanism and Procedure of Analysis Method
6.2.1 Redox Titrations
6.2.2 Iodimetric Titrations
6.2.3 Iodometric Titrations
6.3 Redox Indicators

Laboratory practical (Any four) **(30 Hrs)**

1. Preparation and Standardization of Standard Solutions:
   Sodium hydroxide, Potassium Permanganate, Iodine, Sodium thiosulphate.
2. Complexometric titration of Zn using EDTA
3. Determination of chloride by precipitation titration in water sample.
4. Determination of Fe^{+2} by redox titration in water sample.
5. Determination of total hardness (Ca^{+2}, Mg^{+2}) by complexometric titration.

Reference books:

Theory references:

1. 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.
2. Quantitative Analysis, R.A Day, A.L Underwood, 6th Edition, 1991, Prentice-Hall.
3. Fundamentals of Analytical Chemistry, D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, 9th Edition, Reprint 2014, Cengage Learning.
4. Basic Concepts of Analytical Chemistry, S.M. Khopkar, 3rd Edition, 2008, New Age International Publishers.
5. Essentials of Physical Chemistry, Arun Bahl, B.S. Bahl, G.D. Tuli, 1st Revised Edition 2008, Reprint 2016, S. Chand and Company Limited.
6. Vogel, Arthur Israel [Textbook of quantitative chemical analysis] Vogel's textbook of quantitative chemical analysis. - 5th ed./ revised by ... G. H. Jeffery ... [et al.] 4th ed. 1978.

Laboratory references:

1. 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.
2. Official Methods of Analysis – Dr. William Harwitz, Dr. George W Latimer, 18th Edition, 2005, published by Association of Officiating Analytical Chemists (AOAC).
3. Analytical Techniques in Agriculture, Biotechnology and Environmental Engineerin; A. Nag; 1st Edition, (2006), Prentice Hall of India.
4. Vogel, Arthur Israel [Textbook of quantitative chemical analysis] Vogel's textbook of quantitative chemical analysis. - 5th ed./ revised by ... G. H. Jeffery ... [et al.] 4th ed. 1978.

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSCH32520	**Course Name**	Analytical Techniques in Applied Sciences (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSCH32532	**Course Name**	Analytical Techniques in Applied Sciences (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Department: Chemistry	
Program: B.Sc.	**Type:** Theory + Practical (NEP-2020-NEW)
Subject: Minor- Analytical Techniques in Applied Sciences	**Semester:** 5
Credit: (3T + 1P)	**Total learning hours:** (45 T + 30 P) Hrs

Course description:
This course paper deals about sampling and analysis methods to determine various quality parameters of soil and fertilizer, water-wastewater, industrial solid waste and stack gas, ore and alloy, polymer, petroleum and fuel, pharmaceutical and clinical analysis.

Student learning outcome:
At the end students will be able to learn about
Sampling techniques, principle, chemical reaction and analysis methods of various quality parameters of

- Soil and fertilizer
- Water-wastewater
- industrial solid waste and stack gas
- ore and alloy
- polymer
- petroleum and fuel
- pharmaceutical
- Clinical analysis

Unit 1 Soil and fertilizer analysis **(08 Hours)**

1.1 Sampling
1.2 Principle, chemical reaction and methods of analysis:
1.2.1 pH and moisture
1.2.2 Kjeldahl and total nitrogen
1.2.3 Organic carbon
1.2.4 Total phosphorous and phosphate
1.2.5 Na and K, ion exchange capacity
1.2.6 Pesticides and insecticides
1.3 Soil health standards

Unit 2 Industrial wastewater analysis **(08 Hours)**

2.1 Sampling
2.2 Principle, chemical reaction and methods of analysis:
2.2.1 D.O., BOD and COD
2.2.2 Phenol and TOC
2.2.3 Metals and heavy metals
2.3 Disposal standards

Unit 3 Industrial solid waste and stack gas analysis **(06 Hours)**

3.1 Sampling
3.2 Principle, chemical reaction and methods of analysis:
3.2.1 Proximate analysis of solid waste
3.2.2 Ultimate analysis of solid waste

3.2.3 Particulate matter
3.2.4 CO, SOx, NOx
3.3 Quality standards

Unit 4 Petroleum and fuel analysis **(05 Hours)**

4.1 Sampling and determination
4.1.1 Moisture, volatiles, ash and fixed carbon
4.1.2 Calorific value
4.1.3 Flash and fire Point
4.1.4 Aniline point
4.1.5 Octane number and cetane number

Unit 5 Clinical analysis **(06 Hours)**

5.1 Sampling
5.2 Estimation of
5.2.1 Blood chloride, Na and K
5.2.3 Blood glucose
5.2.4 Blood urea and BUN
5.2.5 Creatinine and billirubin
5.2.6 Cholesterol and haemoglobin

Unit 6: Polymer analysis **(12 Hours)**

6.1 Chemical analysis of polymers: X-ray diffraction analysis, thermal analysis, TGA, DTA.
6.2 Physical testing of polymers: Mechanical properties, fatigue testing, impact testing, tear resistance, hardness, abrasion resistance
6.3 Thermal properties: Softening temperature, flammability
6.4 Optical properties: Transmittance, color, gloss, haze and transparency
6.5 Electrical properties: Dielectric constant and loss factor, resistively, dielectric strength, electronic properties.
6.6 Chemical properties: Resistance to solvents, vapor permeability, weathering.
6.7 Measurement of molecular weight and size: (4 L) End group analysis, colligative properties measurements, solution viscosity and molecular size.

Laboratory practical (Any four) **(30 Hrs)**

1. Determination of Organic Carbon in soil sample.
2. Determination of Nitrogen in soil sample.
3. Determination of Phosphorous in soil sample.
4. Determination of BOD in industrial wastewater sample.
5. Determination of NOx in Air sample.
6. Determination of SOx in Air sample.
7. Determination of Blood Sugar by Folin-Wu method.
8. Determination of Blood Urea by DAM method.

Reference books:

Theory references:

1. 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.
2. Analytical Chemistry, H. Kaur, 1st Edition, 2013, Pragati Prakashan.
3. Quantitative Analysis, R.A Day, A. L. Underwood, 6th Edition, 1991, Prentice-Hall.
4. 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.
5. Environmental Chemistry - A. K. De, 7th Edition, 2015, New Age international (P) Ltd.
6. Official Methods of Analysis – Dr. William Harwitz, Dr. George W Latimer, 18th Edition, 2005, published by Association of Officiating Analytical Chemists (AOAC).
7. Fundamentals of Analytical Chemistry, D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, 9th Edition, Reprint 2014, Cengage Learning.
8. Analytical Instrumentation, Bela G. Liptak, 1st Edition,1994, 1st Indian Reprint, 2012, Chilton Book Company.
9. Analytical Techniques in Agriculture, Biotechnology and Environmental Engineering, A. Nag, 1st Edition, 2006, Prentice Hall of India Pvt. Ltd.
10. Laboratory Manual on Engineering Chemistry, S.K. Bhasin and Sudha Rani, 3rd Edition, Reprint 2011, Dhanpat Rai Publishing Company (P) Ltd.

Laboratory references:

1. 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.
2. Official Methods of Analysis, Dr. William Harwitz, Dr. George W Latimer, 18th Edition, 2005, published by Association of Officiating Analytical Chemists (AOAC).
3. Analytical Techniques in Agriculture, Biotechnology and Environmental Engineering, A. Nag, 1st Edition, 2006, Prentice Hall of India Pvt. Ltd.
4. Laboratory Manual on Engineering Chemistry, S.K. Bhasin and Sudha Rani, 3rd Edition, Reprint 2011, Dhanpat Rai Publishing Company (P) Ltd.

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSMB32526	**Course Name**	Basics of Clinical Biochemistry (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSMB32538	Course Name	Basics of Clinical Biochemistry (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Term end examinations (SEE)	Total
1	0	0	1	10	15	25

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Basics of Clinical Biochemistry

Name of faculty: Science	**Department:** Microbiology
Program: B. Sc Sem-5	**Type:** Minor
Subject: Basics of Clinical Biochemistry	
Credit: 4	**Total learning hours:**45
Course description: The main aim of the subject is to inform the knowledge about carbohydrates, lipoproteins and plasma protein. Also add the understanding of isoenzymes and enzyme pattern in various diseases. The information regarding electrolytes and vitamins will enhance the depth of subject.	
Student learning outcome: At the end of the course, the students will get knowledge of • Regulation and significance of blood glucose level, Metabolic changes occur in Diabetes and its diagnostic profile tests • Plasma proteins, its functions and separation methods and clinical significance • Clinical significance of serum cholesterol level, types of lipoproteins and its metabolism and its pathological variation • Enzymes, Coenzymes and Isoenzymes. • Classification, Structure, daily requirements, dietary sources, biological functions and deficiency manifestation of vitamins. • Biochemical function, Dietary requirement, Source, Absorption and excretion of minerals & electrolytes.	

Reference Book:

- P.B. Godkar, (2014), Textbook of Medical Laboratory Technology, 3rd ed., Bhalani Publishing House, Mumbai, India. (ISBN: 9789381496190)
- U. Satyanarayan, U. Chakrapani, Biochemistry, 3rd edition, Books & Allied Pvt Ltd Kolkatta (ISBN: 9788187134800)
- Rastogi S.C. 2nd edition, Biochemistry, Jaypee Brothers Publishers Tata McGrow Hill Publishing Company Limited
- Pankaja Naik, (2012), first edition, Essentials of biochemistry, Jaypee Brothers Medical Publishers (ISBN: 9789350254912

Unit-1: Carbohydrate **(Duration: 08 Hrs)**

1.1 Definition, Classification and Function

1.2 Digestion, absorption and general carbohydrate metabolism

1.3 Regulation of blood glucose by hormones

1.4 Blood Glucose Estimation and its significance

1.5 Diabetes mellitus

Unit-2: Lipid and Lipoprotein **(Duration: 07 Hrs)**

2.1 Lipid: Definition, Classification and Function

2.2 Fatty acids- Classification, Essential fatty acids.

2.3 Lipoprotein: Introduction, Classification and Separation

2.4 Metabolism and Clinical Disorder of Lipoprotein

2.5 Lipid Profile Tests- Cholesterol, Triglyceride & Lipoproteins

Unit-3: Plasma Protein **(Duration: 07 Hrs)**

3.1 Definition, Classification and Functions of individual plasma protein

3.2 Plasma proteins and Albumin estimation, its clinical significance and A:G ratio

3.3 Electrophoretic pattern of protein fractions in health and disease

Unit-4: Enzymes **(Duration: 07 Hrs)**

4.1 Nomenclature and Classification of Enzyme

4.2 Factors affecting Enzyme activity

4.3 Co-enzyme

4.4 Isoenzymes: LDH, CK and ALP

4.5 Enzyme pattern in diseases

Unit-5: Vitamins **(Duration: 08 Hrs)**

5.1 Introduction and Classification

5.2 Daily requirements, dietary sources, biological functions and deficiency manifestation of fat-soluble vitamins

5.3 Daily requirements, dietary sources, biological functions and deficiency manifestation of water-soluble vitamins

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Unit-6: Electrolyte and Minerals **(Duration: 08 Hrs)**

6.1 General functions and classification of minerals

6.2 Biochemical function, Dietary requirement, Source, Adsorption, Excretion and Clinical conditions related to: Calcium, Phosphorus and Iron

6.3 Biochemical function, Dietary requirement, Source, Adsorption, Excretion and Clinical conditions related to: Sodium, Potassium and Chloride

List of Practical

1. Estimation of blood Sugar
2. Estimation of serum total protein
3. Estimation of serum albumin
4. Estimation of serum triglyceride
5. Estimation of micro albumin in urine

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSMB32523	**Course Name**	Concept of Fermentation Technology (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSMB32535	**Course Name**	Concept of Fermentation Technology (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Concept of Fermentation Technology

Name of Faculty: Sciences	**Department:** Microbiology
Program: B.Sc. (Hons) Sem 5	**Type:** Minor
Subject: Concept of Fermentation Technology	
Credit: 04	**Total teaching hours:** 45
Course description: This course focuses on the technological aspect of fermentation process like significance and types of ancillary parts of fermenter. It explains how to measure and control various physical and chemical parameters during fermentation process. This course helps to understand significance of microbial growth kinetics in designing fermentation process.	
Learning Outcomes: By the end of the course, students will be able to: • Understand microbial growth kinetics • Significance and usefulness of ancillary parts of fermenter • How to measure different fermentation process parameters. • Learn economic aspects related to fermentation process.	

Reference:

1. Stanbury, P.F., (2006). Principles of Fermentation Technology. 2nd Ed., Elsevier Science Ltd. ISBN: 9780750645010.
2. Waites, M.J., et al., (2001). Industrial Microbiology: An Introduction, 1st Ed., Blackwell Publishing. ISBN: 9780632053070.

Unit-1: Microbial growth kinetics **(07 Hours)**

1.1 Batch growth

1.2 Continuous growth kinetics

1.3 Fed batch culture

1.4 Monitoring microbial growth in culture

1.5 The component parts of a fermentation process

Unit-2: Aeration & Agitation device for fermenter **(08 Hours)**

2.1 The agitator

2.2 Baffles

2.3 The aeration systems

2.4 Oxygen supply: Determination of K_La Value

2.5 Fluid Rheology

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Unit-3: Ancillary Equipment of Fermenter **(08 Hours)**

3.1 Sample port

3.2 Feed Ports

3.3 Sensor Probes

3.4 Foam control

3.5 Valves and Steam Traps

Unit-4: Measurement & Control of Physical Process Parameters **(08 Hours)**

4.1 Types of sensors used to monitor fermentation process

4.2 Measurement & Control of Physical Parameters (Temperature, Pressure, Agitator shaft power, Foam, Weight & Flow rate)

Unit-5: Measurement & Control of Chemical Process Parameters **(06 Hours)**

4.3 Measurement & Control of Chemical Parameters (pH, Redox, Oxygen, CO_2, Exit gas analysis and online analysis of other chemical factors)

4.4 Control system

Unit-6: Fermentation Economics (Stanbury) **(08 Hours)**

6.1 Isolation of Microorganisms of Potential Industrial Interest

6.2 Strain Improvement

6.3 Market Potential

6.4 Plant & Equipment

6.5 Media, Air Sterilization, Heating & Cooling

6.6 Aeration & Agitation

6.7 Recovery Cost, Water Usage & Recycling, Effluent Treatment

List of Practical

1. To study growth kinetics of bacterial culture at various substrate concentration.
2. Determination of K_La by sulphite oxidation method.

****

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSES32516	**Course Name**	Ethnobotany (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSES32528	**Course Name**	Ethnobotany (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of Faculty: Science	**Department**: Environmental Science
Program: B.Sc. (Hons)	**Type:** Minor
Subject: Ethnobotany	**Semester:** 5
Credits: 03 + 01 = 04	

Course Description: This course introduces students to the fundamentals of ethnobotany and its significance. It also explores plant biodiversity and its cultural and economic relevance.

Student Learning Outcomes (SLOs):

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

1. Define ethnobotany and explain its interdisciplinary nature.
2. Identify plants with ethnobotanical importance and describe their uses.
3. Analyze the role of indigenous knowledge in plant-based medicine and food systems.
4. Evaluate the impact of globalization on traditional plant usage.
5. Apply ethnobotanical principles in conservation and sustainable resource management.

Unit 1: Introduction to Ethnobotany (7 Hours)

1.1 Definition, history, and scope of ethnobotany.
1.2 Interdisciplinary nature and relevance to modern science.
1.3 Role of ethnobotany in biodiversity conservation and sustainable development.

Unit 2: Indigenous Knowledge Systems and Traditional Practices (7 Hours)

2.1 Traditional knowledge and its transmission across generations.
2.2 Role of plants in cultural practices, rituals, and folklore.
2.3 Indigenous agricultural and ecological knowledge.

Unit 3: Ethnomedicinal Plants and Their Uses (8 Hours)

3.1 Classification of medicinal plants and their therapeutic applications.
3.2 Phytochemicals and active compounds in ethnomedicine.
3.3 Role of ethnobotany in modern drug discovery.

Unit 4: Economic and Nutritional Aspects of Ethnobotany (8 Hours)

4.1 Wild edible plants and their nutritional value.
4.2 Ethnobotany in food security and sustainable agriculture.
4.3 Commercial utilization of ethnobotanical resources (herbal cosmetics, dyes, fibers, etc.).

Unit 5: Conservation and Sustainable Management of Ethnobotanical Resources (7 Hours)

5.1 Threats to ethnobotanical knowledge and plant resources.
5.2 Conservation strategies: In situ and ex situ conservation.
5.3 Policies and legal frameworks for protecting traditional knowledge (CBD, IPR, TKDL).

Unit 6: Research Methods and Applications in Ethnobotany (8 Hours)

6.1 Methods of ethnobotanical data collection (surveys, interviews, field studies).
6.2 Documentation and validation of traditional plant knowledge.
6.3 Modern technological advancements in ethnobotanical research.

Practicals:

1. Collection and identification of local medicinal plants, preparation of herbarium specimens, and documentation of their uses.
2. Extraction of bioactive compounds from medicinal plants using solvents.
3. Conducting field visits to indigenous communities, interviewing local healers and farmers, and recording traditional plant usage for medicine, food, and rituals.
4. Developing models for in situ and ex situ conservation and preparing guidelines for preserving ethnobotanical resources.

References:

1. Jain, S. K. (1991). *Manual of Ethnobotany*. Scientific Publishers.
2. Cotton, C. M. (1996). *Ethnobotany: Principles and Applications*. John Wiley & Sons.
3. Balick, M. J., & Cox, P. A. (1996). *Plants, People, and Culture: The Science of Ethnobotany*. Scientific American Library.
4. Schultes, R. E., & von Reis, S. (1995). *Ethnobotany: Evolution of a Discipline*. Timber Press.
5. Battacharya, D. (2011). *Ethnobotany and Medicinal Plants*. I.K. International Publishing House.

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSBT32522	**Course Name**	Forensic Biology and Environmental Forensics (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSBT32534	**Course Name**	Forensic Biology and Environmental Forensics (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of Faculty: Science	**Department**: Environmental Science
Program: B.Sc. (Hons)	**Type:** Minor
Subject: Forensic Biology and Environmental Forensics	**Semester:** 5
Credits: 03 + 01 = 04	
Course Description: This course provides an introductory understanding of forensic biology as a specialization of forensic sciences. It also will introduce students to the world of environmental investigations in case of damage caused by environmental events.	
Student Learning Outcomes (SLOs): At the end of this course, students will be able to: 1. Explain Key Concepts of Forensic Biology 2. Apply Biological Techniques and Demonstrate proficiency in laboratory methods 3. Analyze Biological Evidences 4. Critically Assess Case Studies and examine real-world forensic cases to assess the role of biological evidence in criminal investigations and judicial proceedings. 5. Understand the significance of investigation in ascertaining the cost of damage caused by environmental accidents. 6. Apply methods of determining Environmental Damage Compensations.	

Unit 1: Introduction to Forensic Biology **(07 Hours)**

1.1 Introduction to Forensics and its branches
1.2 Forensic biology: A sub discipline of Forensics
1.3 Laboratory Analysis of Biological Evidence
1.4 History of Forensic Biology
1.5 Forensic Science Services Related to Forensic Biology

Unit 2: Basic Techniques in Forensic Biology **(07 Hours)**

2.1 Recognition of Biological Evidence
2.2 Searches for Biological Evidences
2.3 Collection and Marking of Biological Evidences
2.4 Documentation, Packaging and Transport of Evidences

Unit 3: Identification of Blood **(07 Hours)**

3.1 Biological Properties of Blood
3.2 Presumptive Assays for Identification
3.3 Confirmatory Assays for Identification

Unit 4: Blood Group Typing and Other Techniques **(08 Hours)**

- 4.1 Introduction to blood group systems
- 4.2 Forensic Applications of Blood Group Typing
- 4.3 Blood Group Typing Techniques
- 4.4 Plant-based Evidences in Forensic Biology
- 4.5 Microorganisms in Forensic Biology

Unit 5 : Environmental Forensics and EDC **(08 Hours)**

- 5.1 Definition, Scope and Applications of Environmental Forensics
- 5.2 Introduction to Environmental Damage Compensation
- 5.3 Scope of EDC & Standard Flow Model for estimating EDC
- 5.4 Preliminary Investigation and Analysis of Data
- 5.5 Identification and Assessment of Direct and Indirect Liabilities
- 5.6 Identify remediation and restoration methods

Unit 6: Methods of EDC Estimation **(08 Hours)**

- 6.1 Examples of Directly Impacted Environmental Components
- 6.2 Method for the Estimation of EDC of Ambient Air
- 6.3 Method for the Estimation of EDC of Surface Water
- 6.4 Method for the Estimation of EDC of Ground Water
- 6.5 Method for the Estimation of EDC of Soil

Practicals:

1. Identification of blood stains through presumptive tests (Hydrogen Peroxide test/Kastle-Meyer Test).
2. Study of diatoms for crimes involving drowning.
3. Preliminary investigation of an environmentally damaged site.

References:

1. Forensic Biology by Richard Li, CRC Press. ISBN: 978-1032098791.
2. General Framework For Imposing Environmental Damage Compensation by Central Pollution Control Board.

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSCH32521	**Course Name**	Forensic Chemistry (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSCH32533	**Course Name**	Forensic Chemistry (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Department: Chemistry	
Program: B.Sc.	**Type:** Theory + Practical (NEP-2020-NEW)
Subject: Minor: Forensic Chemistry	**Semester:** 5
Credit: (3T + 1P)	**Total learning hours: (45 T + 30 P)** Hrs
Course description: This course explains the strong relationship between forensic science and chemistry. This course introduces various methods of analysis of different types of chemicals of forensic importance. It also educates the students regarding legal aspects of forensic chemistry.	
Student learning outcome: Students will be able to – • Collect and preserve chemical evidences. • Identify the illicit liquors with forensically sound techniques. • Know about importance of dyes in crime solving process • Characterize the narcotics, drugs and psychotropic substances. • Analyse trace amounts of petroleum products in crime scene evidence and contaminants in petroleum products.	

Unit-1 Introduction to forensic chemistry **(06 Hrs)**

1.1 Definition and scope
1.2 Introduction to forensic chemistry and forensic chemistry division at FSL
1.3 Important cases associated with forensic chemistry and cases which require chemical analysis
1.4 Presumptive and confirmatory testing of chemical evidences
1.5 Micro-chemical methods of analysis

Unit-2 Forensic analysis of beverages **(08 Hrs)**

2.1 Alcoholic and non-alcoholic beverages and their composition
2.2 Analysis of alcohols: Country made liquor and illicit liquor
2.2.1 Estimation of ethyl alcohol in blood and urine
2.3 Medicinal preparations containing alcohol and drugs as constituents
2.4 Alcohol and prohibition, consequences of drunken driving
2.5 Case Study

Unit-3 Dyes and colored compounds **(06 Hrs)**

3.1 Definition and types of dyes of forensic importance
3.2 Scope and significance of dyes in crime investigation
3.3 Comparison of dyes in fibres and different inks by TLC and UV-VIS Spectrophotometer
3.4 Dyes used as the clues for trap cases
3.5 Mechanism of colour reaction

Unit-4 Drugs of abuse **(09 Hrs)**

4.1 Classification of drugs of abuse (Narcotic drugs, psychotropic substances, designer drugs)
4.2 Drug Effects and drug hazards
4.3 Analysis of narcotic drugs and psychotropic substances

4.3.1 Analytical techniques for identification of drugs
4.4 Drug addicts and crimes
4.5 Drug of abuse in sports

Unit-5 Petroleum products and their adulterations **(09 Hrs)**

5.1 Analysis of petrol, kerosene, diesel, lubricants by BIS methods and ASTM methods
5.2 Detection of adulterants of gasoline, diesel and engine oils (parameters like-Flash point, distillation range, density, kinematic -viscosity, smoke point, aniline point)
5.3 Chemistry of fire, fire pattern, extraction of fire accelerants from fire debris
5.4 Analysis of fire accelerants by UV visible spectrophotometry, TLC, Head Space GC
5.5 Analysis of residues in forensic exhibits

Unit-6 Legal aspects in forensic chemistry **(07 Hrs)**

6.1 The Poisons Act, 1919, and Section 284 of IPC, 1860 (Negligent conduct with respect to poisonous substance)
6.2 Explosives Act 1984, (Definition, powers of central Govt. and licensing authority, offences and penalties) and section 286 of IPC, 1860, (negligent conduct with respect to explosive substance)
6.3 Explosive Substances Act 1908, (definition, offences and penalties).
6.4 The Industries (development and regulation) Act, 1951

Laboratory practical (Any four) **(30 Hrs)**

1. To check the alcohol presence in different liquor.
2. Phenolphthalein test for trap cases.
3. To separate explosive substances using thin layer chromatography.
4. To carry out analysis of gasoline.
5. To carry out analysis of diesel.
6. To carry out analysis of kerosene oil.

Reference books:

Theory/Practical

- Basic Principles of Forensic Chemistry by JaVed I. Khan • Thomas J. Kennedy Donnell R. Christian, Jr.
- Clarke's Analysis of Drugs and Poisons 3rd Ed.
- R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
- Kennedy, Thomas J., Christian, Jr., Donnell Basic Principles of Forensic Chemistry, Springer
- Feigl; Spot Test in Organic Analysis, Elsevier Pub., New Delhi.
- Parikh C.K; Text Book of Medical Jurisprudence Forensic Medicines and Toxicology. CBS Pub. New Delhi.
- Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, The Foundation Press, Inc., New York (1995).

- F.G. Hofmann, A Handbook on Drug and Alcohol Abuse, 2nd Edition, Oxford University Press, New York (1983).
- Bridges, B.C. Criminal Investigation, Practical Fingerprinting, Thumb Impressions, Handwriting Expert Testimony, Opinion Evidence. University book Agency: Allahabad; (2000).
- Instrumental Method of Chemical Analysis. Chatwal & Anand, Himalya Publication.
- S. N. Tiwari, Analytical Toxicology, Govt. of India publications, New Delhi 1987
- S.B. Karch, The Pathology of Drug Abuse, CRC Press, Boca Raton (1996).
- Practical aspects of forensic chemistry by Anil Kumar Teotia (2013)

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences				
Faculty	Science	**Program**	B.Sc. ES/MB/BT/CH	
Year	3	**Version**	3	
Semester	V	**Effective From**	July 2025	
Course Code	BSES32515	**Course Name**	Forest Management (TH)	

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences				
Faculty	Science	**Program**	B.Sc. ES/MB/BT/CH	
Year	3	**Version**	3	
Semester	V	**Effective From**	July 2025	
Course Code	BSES32527	**Course Name**	Forest Management (PR)	

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of Faculty: Science	**Department**: Environmental Science
Program: B.Sc. (Hons)	**Type:** Minor
Subject: Forest Management	**Semester:** 5
Credits: 03 + 01 = 04	

Course Description:
This course aims to provide a basic understanding of principles and scope of horticulture. It also explores different horticultural crops, their management, and economic importance.

1. To introduce ecological principles and processes governing forest ecosystems.
2. To understand the role of forests in biodiversity conservation, climate regulation, and livelihoods.
3. To study threats to forest ecosystems and strategies for their conservation.
4. To analyze national and global forest policies and legal frameworks.
5. To build field-based knowledge and skills for participatory forest management.

Student Learning Outcomes (SLOs):
At the end of the course, students will be able to:

1. Define ecological dynamics and biodiversity of forest ecosystems.
2. Understand major forest types of India and their ecological and economic significance.
3. Determine threats to the forest ecosystem.
4. Evaluate conservation strategies including protected areas and community participation
5. Analyze forest-related policies and laws at the national and international level.
6. Apply basic ecological techniques for forest assessment and conservation planning.

Unit 1: Introduction to Forest Ecology (6 Hours)

1.1 Definition and scope of forest ecology
1.2 Forest ecosystem structure and functions
1.3 Energy flow and nutrient cycling in forest ecosystems

Unit 2: Forest Types and Biodiversity in India (8 Hours)

2.1 Classification of Indian forests (Champion & Seth classification)
2.2 Tropical, temperate, alpine, mangrove, and dry deciduous forests
2.3 Biodiversity richness: flora and fauna, Sacred groves and traditional forest conservation practices

Unit 3: Threats to Forest Ecosystems (7 Hours)

3.1 Deforestation, forest fragmentation, mining, and infrastructure projects
3.2 Invasive species, forest fires, Overgrazing and unsustainable resource extraction climate change impacts
3.3 Human-wildlife conflict

Unit 4: Forest Conservation and Management Strategies (8 Hours)

4.1 In-situ and ex-situ conservation methods, Role of indigenous knowledge in forest conservation
4.2 Protected areas: national parks, sanctuaries, biosphere reserves
4.3 Joint Forest Management (JFM) and community forestry

Unit 5: Forest Policies, Laws and Governance in India (8 Hours)

5.1 Indian Forest Act (1927), Forest Conservation Act (1980), Wildlife Protection Act (1972) National Forest Policy (1988), Forest Rights Act (2006)
5.2 Role of institutions: MoEFCC, Forest Survey of India, State Forest Departments
5.3 Forest certification, CAMPA, and ecotourism guidelines

Unit 6: Global Forest and Climate Policy Frameworks (8 Hours)

6.1 UNFF, REDD+, Convention on Biological Diversity (CBD), UNFCCC
6.2 Paris Agreement and forests in climate mitigation
6.3 Forests in international trade and carbon credits

Practicals:

1. Identify local forest cover types using digital tools
2. Identification of fire-prone zones and discussion on causes
3. Prepare a case study on Human-wildlife conflict
4. Calculate Biodiversity richness of flora and fauna of forest. (Any nearby)

References:

1. Odum, E.P. (2005). *Fundamentals of Ecology*. Brooks/Cole.
2. Singh, J.S., Singh, S.P., & Gupta, S.R. (2014). *Ecology, Environmental Science and Conservation*. S. Chand.
3. Gadgil, M., & Guha, R. (2005). *The Use and Abuse of Nature*. Oxford University Press.
4. FSI (2023). *India State of Forest Report*. Forest Survey of India, MoEFCC.
5. MoEFCC, GoI. *National Forest Policy, Forest Rights Act Guidelines, CAMPA Reports*.
6. CBD & UNFCCC Documents on REDD+, Climate Change, and Biodiversity Conservation
7. ICFRE Manuals on Forest Biodiversity, Management, and Carbon Sequestration

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences				
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH
Year	3		**Version**	3
Semester	V		**Effective From**	July 2025
Course Code	BSES32518	**Course Name**	Industrial Safety and Accident Prevention (TH)	

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences				
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH
Year	3		**Version**	3
Semester	V		**Effective From**	July 2025
Course Code	BSES32530	**Course Name**	Industrial Safety and Accident Prevention (PR)	

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of Faculty: Science	**Department**: Environmental Science
Program: B.Sc. (Hons)	**Type:** Minor
Subject: Industrial Safety and Accident Prevention	**Semester:** 5
Credits: 03 + 01 = 04	
Course Description: This course provides an understanding of industrial safety principles and accident prevention techniques. It also explores various accident investigation and reporting mechanisms.	
Student Learning Outcomes (SLOs): At the end of the course, students will be able to: 1. Recognize industrial hazards and develop appropriate risk mitigation strategies. 2. Apply safety standards and regulations to industrial operations. 3. Investigate accidents, determine root causes, and propose corrective actions. 4. Implement workplace safety programs and emergency response plans. 5. Conduct safety audits and promote a safety culture within industries.	

Unit 1: Principles of Accident Prevention and Analysis **(07 Hours)**

1.1 Definition: Incident, accident, injury, dangerous occurrences, unsafe acts, unsafe conditions, hazards, error etc.

1.2 Accident Prevention : Theories / Models of accident occurrences, Principles of accident prevention

1.3 Hazard identification and analysis

1.4 Fault tree analysis, Event tree analysis, failure modes and effects analysis

Unit 2: Hazard Identification and Risk Assessment **(07 Hours)**

2.1 Methods of hazard identification and classification.

2.2 Risk assessment techniques (HAZOP, FMEA, JSA).

2.3 Principles of accident prevention and safety hierarchy.

Unit 3: Accident Investigation and Reporting **(08 Hours)**

3.1 Accident causation theories (Domino Theory, Human Factor Theory, Multiple Causation Theory).

3.2 Steps in accident investigation and root cause analysis.

3.3 Documentation and reporting of industrial accidents.

3.4 Safety performance indicators and accident statistics.

Unit 4: Fire, Electrical, and Chemical Safety **(08 Hours)**

4.1 Types and causes of industrial fires and explosions.

4.2 Fire protection and firefighting equipment.

4.3 Electrical hazards and preventive measures.

4.4 Safe handling, storage, and disposal of hazardous chemicals.

4.5 Personal Protective Equipment (PPE) for fire, electrical, and chemical safety.

Unit 5: Safety Management Systems **(07 Hours)**

5.1 Elements of an effective safety management system.
5.2 Workplace safety policies and safety culture development.
5.3 Safety audits, inspections, and training programs.
5.4 Behavior-based safety and leadership in safety.

Unit 6: Emergency Preparedness and Disaster Management **(08 Hours)**

6.1 Emergency response planning and crisis management.
6.2 Evacuation procedures and first aid training.
6.3 Industrial Disaster preparedness and industrial disaster case studies.
6.4 Business continuity planning.

Practicals:

1. Workplace Hazard Identification and Risk Assessment by Identifying potential hazards and recommending control measures.
2. Fire hazard identification and prevention measures.
3. Investigation techniques and report writing.
4. Designing and evaluating workplace safety plan.

References:

1. Mistry K.U (2012): Fundamentals of Industrial Safety & Health – I, Siddharth Prakashan, Ahmedabad.
2. Mistry K.U (2012). Fundamentals of Industrial Safety & Health – II, Siddharth Prakashan, Ahmedabad.
3. Gupta, R. (2018). *Industrial Safety Management*. McGraw-Hill.
4. Reese, C. D. (2012). *Occupational Health and Safety Management: A Practical Approach*. CRC Press.
5. Goetsch, D. L. (2019). *Occupational Safety and Health for Technologists, Engineers, and Managers*. Pearson.
6. Manuele, F. A. (2014). *Advanced Safety Management: Focusing on Z10 and Serious Injury Prevention*. Wiley.
7. Shah R.C (2018): Safety Management, Capital Offset, Gandhinagar.

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSES32517	**Course Name**	Industrial Safety and Management (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSES32529	**Course Name**	Industrial Safety and Management (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of Faculty: Science	**Department**: Environmental Science
Program: B.Sc. (Hons)	**Type:** Minor
Subject: Industrial Safety and Management	**Semester:** 5
Credits: 03 + 01 = 04	

Course Description: This course provides an in-depth understanding of industrial safety standards and regulations.

1. To identify various hazards in different industries and their impact on health and the environment.
2. To study risk assessment and accident prevention techniques.
3. To explore fire safety, electrical safety, and hazardous material handling.
4. To develop skills in implementing safety measures and emergency response planning.

Student Learning Outcomes (SLOs):

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

1. Identify potential industrial hazards and evaluate risks associated with them.
2. Apply safety regulations and best practices in workplace environments.
3. Develop accident prevention strategies and emergency management plans.
4. Implement personal protective equipment (PPE) and industrial safety measures.
5. Assess the effectiveness of workplace safety programs.

Unit 1: Introduction to Industrial Safety **(07 Hours)**

1.1 Importance of industrial safety and accident prevention.

1.2 Types of workplace hazards: physical, chemical, biological, ergonomic, and Psychological.

1.3 Occupational Safety and Health Administration (OSHA) and Indian safety regulations.

Unit 2: Risk Assessment and Hazard Control **(07 Hours)**

2.1 Methods of hazard identification and risk assessment.

2.2 Hierarchy of hazard control: elimination, substitution, engineering, administrative controls, and PPE.

2.3 Safety audits and workplace monitoring.

Unit 3: Fire and Electrical Safety **(08 Hours)**

3.1 Fire hazards: types, causes, and prevention.

3.2 Fire detection, suppression, and firefighting equipment.

3.3 Electrical hazards: short circuits, overloading, grounding, and insulation.

Unit 4: Chemical and Hazardous Material Safety (8 Hours)

4.1 Handling, storage, and disposal of hazardous chemicals.

4.2 Safety Data Sheets (SDS) and Globally Harmonized System (GHS) of Classification.

4.3 Industrial hygiene and exposure monitoring.

Unit 5: Machinery and Workplace Safety (7 Hours)

5.1 Machine guarding and safety interlocks.

5.2 Ergonomics and occupational health.

5.3 Safety measures in construction, manufacturing, and chemical industries.

Unit 6: Safety Management (8 Hours)

6.1 Emergency planning and disaster management.

6.2 First aid and medical response in industrial settings.

6.3 Case studies of major industrial accidents and lessons learned.

Practicals:

1. Identifying potential hazards and proposing control measures for industrial chemical laboratories.
2. Identifying electrical hazards and implementing preventive measures.
3. Demonstrating proper selection and use of PPE.
4. Performing first aid for common industrial injuries.

References:

1. Shah R.C (2018): Safety Management, Capital Offset, Gandhinagar.
2. Mistry K.U (2012): Fundamentals of Industrial Safety & Health – I, Siddharth Prakashan, Ahmedabad.
3. Mistry K.U (2012): Fundamentals of Industrial Safety & Health – II, Siddharth Prakashan, Ahmedabad.
4. Gupta, R. (2018). *Industrial Safety Management*. McGraw-Hill.
5. Reese, C. D. (2012). *Occupational Health and Safety Management: A Practical Approach*. CRC Press.
6. Goetsch, D. L. (2019). *Occupational Safety and Health for Technologists, Engineers, and Managers*. Pearson.
7. Manuele, F. A. (2014). *Advanced Safety Management: Focusing on Z10 and Serious Injury Prevention*. Wiley.

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences			
Faculty	Science	**Program**	B.Sc. ES/MB/BT/CH
Year	3	**Version**	3
Semester	V	**Effective From**	July 2025
Course Code	BSMB32537	**Course Name**	Introduction to Clinical Pathology and Histopathology (PR)

Teaching Scheme				Examination Scheme		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences			
Faculty	Science	**Program**	B.Sc. ES/MB/BT/CH

Year	3		Version	3		
Semester	V		Effective From	July 2025		
Course Code	BSMB32525	Course Name	Introduction to Clinical Pathology and Histopathology (TH)			
Teaching Scheme				Examination Scheme		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Term end examinations (SEE)	Total
3	3	0	0	40	35	75

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Introduction to Clinical Pathology & Histopathology

Name of faculty: Science	**Department:** Microbiology
Program: B.Sc. Sem-5	**Type:** Minor
Subject: Introduction to Clinical Pathology & Histopathology	
Credit: 4	**Total learning hours:**45
Course description: The main aim of the subject is to inform the knowledge about formation and collection of various clinical samples (Urine, CSF, Semen, Sputum etc.) Histopathology techniques are included to widen the view of the subject. The students are imparted basic training of theoretical and practical in the field of Clinical pathology & Histopathology.	
Student learning outcome: At the end of the course, the students will get knowledge of • Routine clinical laboratory investigation (Urine, CSF, Semen, Sputum etc.). • Collection of clinical samples and their processing. • Pathological sample analysis reporting and recording of data. • Fixation and decalcification of Organ/ Tissue • Tissue processing method • Principle and staining procedure of HE staining technique for study of normal as well as abnormal tissue	

Reference Book:

- P.B. Godkar, (2014), Textbook of Medical Laboratory Technology, 3rd ed., Bhalani Publishing House, Mumbai, India. (ISBN: 9789381496190)
- Ochei J. &Kolhatkar A. (2000), Medical Laboratory Science: Theory & Practice, Tata McGraw Hill Pub. (ISBN: 9780074632239)
- Sood R. (1994) Medical Laboratory Technology, 4th ed., Jaypee Brothers. (ISBN: 9788180615917)
- Kawthalkar S M, Essential of Clinical Pathology, 2nd ed., Jaypee Brothers. (ISBN: 9789386150691)

Unit-1: Urine Analysis **(Duration: 08 Hrs)**

1.1 Formation, Composition, Indication, Collection, Preservation & Transportation
1.2 Physical Examination
1.3 Chemical Examination (Glucose, Protein, Ketone)
1.4 Microscopic Examination

Unit-2: Cerebrospinal Fluid (C.S.F) Analysis **(Duration: 07 Hrs)**

2.1 Indication, Composition, Collection, Preservation & Transportation
2.2 Physical Examination
2.3 Chemical Examination (Glucose, Protein)
2.4 Microscopic Examination

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Unit-3: Semen Analysis **(Duration: 08 Hrs)**

3.1 Indication, Composition, Collection, Preservation & Transportation
3.2 Physical Examination
3.3 Chemical Examination
3.4 Microscopic Examination

Unit-4: Gastric Analysis **(Duration: 07 Hrs)**

4.1 Indication, Secretion, Collection & Composition
4.2 Gross examination
4.3 chemical Examination
4.4 Function of Gastro intestinal Hormones

Unit-5: Sputum Analysis **(Duration: 07 Hrs)**

5.1 Indication, Composition, Collection, Preservation & Transportation
5.2 Physical Examination
5.3 Minute Macroscopic Examination
5.4 Microscopic Examination

Unit-6: Histopathology **(Duration: 08 Hrs)**

6.1 Introduction
6.2 Fixation and Types of Fixative
6.3 Decalcification and Decalcifying agents
6.4 Tissue Processing: Dehydration, Clearing, Wax Impregnation, Embedding
6.5 Principle & Procedure of H & E staining

List of Practical

1. Physical Examination of Urine
2. Chemical Examination of Urine
3. Microscopic Examination of Urine
4. Gastric Analysis: Chemical Examination

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSMB32524	**Course Name**	Screening and Improvement of Microorganisms (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSMB32536	**Course Name**	Screening and Improvement of Microorganisms (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Screening and Improvement of Microorganisms

Name of Faculty: Sciences	**Department:** Microbiology
Program: B.Sc. Sem 5	**Type:** Minor
Subject: Screening and Improvement of Microorganisms	
Credit: 04	**Total teaching hours:** 45
Course description: This course introduces about screening techniques used for the isolation of industrially important microorganisms for the diverse sources. It also explain the different strategies of strain improvement of industrially potential strain.	
Learning Outcomes: By the end of the course, students will be able to: • Understand and design screening techniques for isolation of industrially important microorganisms • Apply different strategies for the strain improvement. • Understand concept of scale-up and scale down • Understand regulatory and safety aspects of fermentation strain & product.	

Reference:

1. Stanbury, P.F., (2006). Principles of Fermentation Technology, 2nd Ed., Elsevier Science Ltd. ISBN: 9780750645010.
2. Waites, M.J., et al., (2001). Industrial Microbiology: An Introduction, 1st Ed., Blackwell Publishing. ISBN: 9780632053070.
3. Okafor N., (2007). Modern Industrial Microbiology and Biotechnology, Science Publishers. ISBN: 9781138036147.
4. Richard K.M. & Durbin S.R., (2020). Fermentation and Biochemical Engineering, Vol 1, CBS Publishers & Distributors Pvt Ltd. ISBN: 9789389185911.
5. Creuger W., (2005). Biotechnology: A textbook of industrial microbiology, 3rd Ed., Panima, New Delhi. ISBN: 9789385998638.

Unit-1: Screening of microorganisms **(06 Hours)**

1.1 The nature of metabolic pathways

1.2 Industrially important products of primary & secondary metabolism

1.3 Role of secondary metabolites in the physiology of organism producing them

1.4 Ideal characteristics of production strain

1.5 Strategies for isolation of industrially important microbes

1.6 Primary and secondary screening of industrially important microbes

Unit-2: Strategies of strain improvement – I **(07 Hours)**

2.1 Objectives of strain improvement

2.2 Mutation

2.3 Regulation

Unit-3: Strategies of strain improvement – II **(09 Hours)**

3.1 Recombination

3.2 Protoplast fusion

3.3 Gene technology

3.4 Use of genetic methos

Unit-4: Development of inocula for industrial fermentation **(09 Hours)**

4.1 Criteria for the transfer of inoculum

4.2 Development of inocula for the yeast processes

4.3 Development of inocula for bacterial processes

4.4 Development of inocula for mycelial processes

Unit-5: Scale up & Scale down of Fermentation Process **(07 Hours)**

5.1 Introduction to Scale up & Scale down

5.2 Stages of scale up

5.2 Initial scale up studies

5.3 Variables to be considered when changing fermentation scale

5.4 Scale up of media and fermenter scale up

5.5 Scale up of aeration & agitation regimes in CSTF (Standury – 271 to 272)

5.6 Scale down studies

5.7 Rules of scale down

Unit-6: Regulatory and safety aspects of fermentation strain & product **(07 Hours)**

6.1 Development of pharmaceutical product

6.2 Product Quality & safety

6.3 Manufacturing and environmental safety

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

List of Practical

1. Screening of antimicrobial compound producing microorganisms by Crowded plate method
2. Screening of antimicrobial compound producing microorganisms by Wilkin's method
3. Screening of citric acid and lactic acid producing microorganisms.
4. Screening of cellulase, amylase and protease producing microorganisms.

******

SARVAJANIK UNIVERSITY

INCLUSIVE | INTEGRATED | INNOVATIVE

SKILL ENHANCEMENT COURSE (SEC) SUBJECTS

SEM 5

DETAILED CURRICULUM

(W.E.F. 2025-26)

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSAS35508	**Course Name**	2G Ethanol Plant Operator			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
2	2	0	0	25	25	50

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

2G Ethanol Plant Operator

Name of Faculty: Sciences	**Department:** Microbiology
Program: B.Sc. (Hons)	**Type:** SEC
Course: 2G Ethanol Plant Operator	**Semester:** 5
Credit: 02	**Total teaching hours: 30**
Course description: This course focuses on the process and operation of 2G ethanol plant. It covers essential know how for the operation of 2G ethanol plant which will creat career opportunity for the student as plant operator. It also gives understanding of Indian hydrocarbon industry.	
Learning Outcomes: By the end of the course, students will be able to: 1. Understand hydrocarbon industry and government initiatives on biofuel. 2. Understand steps of 2G ethanol plant operations 3. Learn occupational safety and health risk associated with hydrocarbon industry 4. Learn biomass supply chain system	

Reference:

- Hydrocarbon Sector Skill Council, Participant Handbook: Junior Operator – 2G ethanol plant, HYC/Q4301, Version-1.0, 2020.
- Hydrocarbon Sector Skill Council, Participant Handbook: Logistics Coordinator-Biomass in a "2G Ethanol/ CBG Plant", HYC/Q4301, Version-1.0, 2022.

Unit-1: Introduction of hydrocarbon and biofuel industry **(07 Hours)**

1.1 Introduction of hydrocarbon industry and its sub sector.

1.2 Oil and natural gas companies in India

1.3 Types of biofuels

1.4 Difference between 1G and 2G ethanol and its significance

1.5 Process of 2G ethanol production – Overview

1.6 2G ethanol plants in India

1.7 Government initiative on biofuels

Unit-2: 2G ethanol plant operation **(10 Hours)**

2.1 Introduction to 2G ethanol production process & section in plant

2.2 Biomass / Feedstock material – Type, Suitability, Handling & Storage

2.3 Pre-treatment

2.4 Fermentation, Distillation & Purification Process

Unit-3: Occupational safety and health risk management **(07 Hours)**

3.1 Roles and Responsibilities of 2G Ethanol Plant Operator

3.2 Safety protocol & Emergency response procedure

3.4 Potential health effects from key processes in oil and gas industry

3.5 Personal protective equipment (PPE)

3.6 Sign & Symbols

3.7 Basic fire awareness

Unit-4: Logistics of Biomass and Ethanol **(06 Hours)**

4.1 Process of collection & storage of biomass

4.2 Elements of biomass supply chain model

4.2.1. Farm implements

4.2.2 Transportation of biomass

4.1.3 Stakeholders in supply chain of biomass

4.3 Costing elements of biomass supply chain

****

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB/BT/CH		
Year	3		**Version**	3		
Semester	V		**Effective From**	July 2025		
Course Code	BSAS35509	**Course Name**	Organic Grower			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
2	2	0	0	25	25	50

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Organic Grower

Name of faculty: Science	**Department:** Microbiology
Program: B.Sc. (Hons)	**Type:** SEC
Subject: Organic Grower	**Semester:** 5
Credit: 02	**Total learning hours:** 30
Course description: This course provides a comprehensive understanding of organic farming as a sustainable and environmentally friendly agricultural practice. It explores the key principles of organic agriculture. Students will learn the concept, importance, and practices of organic farming, including compost preparation, soil and water management, crop planning, weed and pest control using eco-friendly techniques, and post-harvest handling. The course also covers the process of organic certification, quality assurance, and marketing strategies for organic produce. This course aims to empower learners to become self-reliant and adopt organic farming as a livelihood or entrepreneurial venture.	
Student learning outcome: After successful completion of the course student will be able to understand 1. The students can understand the Importance, basics, principles and need of organic farming. 2. The students can learn the methods of organic farming, organic nutrients preparation and soil enrichment methods. 3. Navigate **organic certification** and regulatory standards 4. Explore marketing avenues and start **organic farm-based enterprises** 5. Establish entrepreneurial ventures and generate employment.	

UNIT:1 Foundations of Organic Farming **(Duration:08 Hrs)**

1.1 Introduction to Organic Farming

1.2 Importance of Organic Farming

1.3 Planning for Organic Farming

1.4 Factors affecting crop selection

1.5 Seed selection and treatment

UNIT:2 Soil, Water, and Farm Management **(Duration:07 Hrs)**

2.1 Soil nutrient management under organic farming

2.2 Weed control Under organic farming

2.3 Irrigation Management under organic farming

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

UNIT:3 Plant Health, Harvesting, and Certification **(Duration:08 Hrs)**

3.1 Pest and disease management

3.2 Integrated Pest and disease management

3.3 Harvest and post-harvest management

3.4 Quality assurance & certification

UNIT:4 Entrepreneurship and Career Skills **(Duration:07 Hrs)**

4.1 Undertake Business of organic farming

4.2 Hygiene and Cleanliness

4.3 Personal hygiene practice

4.4 Cleanliness around workplace

4.5 Safety and emergency procedure

Reference Book:

- Agriculture Skill Council of India, Participant Handbook: Organic Grower, AGR/Q1202, Version 3.0, Second edition. 2023.

Further Reading:

1. Palaniappan, S. P., & Annadurai, K. (2018). *Organic farming theory & practice*. Scientific publishers.
2. Bashir, Z., Kumar, R., & Nisa, M. (Eds.). (2025). *Organic Farming: A Comprehensive Guide to Sustainable Agriculture*. CRC Press.
3. Sengar, V. S., Shekhar, C., Kumar, D., Singh, A. K., & Doharey, R. K. (2021). A text book of modern organic farming.
4. Dahama, A. K. (2001) *Organic farming for sustainable agriculture*. Agrobios.
5. Jaivik Kheti Sahayak Pustika- National Centre for Organic and Natural Farming, Department of Agriculture & Farmers Welfare, GoI.

****

CURRICULUM FOR

"BACHELOR OF SCIENCE (HONS.)"

B.Sc. (Hons.) Biotechnology
B.Sc. (Hons.) Chemistry
B.Sc. (Hons.) Environmental Science
B.Sc. (Hons.) Microbiology

SEM - 6

w.e.f. Academic Year 2025-26

॥ 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,
Surat-395001, Gujarat, India.
Website: www.sarvajanikuniversity.ac.in
Email: admin@sarvajanikuniversity.ac.in
Email: info@sarvajanikuniversity.ac.in
Mo.:+919979102021 / +9197129 30321
Contact No .+912612660266

Constituent Institute:

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

SARVAJANIK UNIVERSITY

INCLUSIVE | INTEGRATED | INNOVATIVE

Faculty of Science

B. Sc. (Honors)

B.Sc. (Hons.) Biotechnology
B.Sc. (Hons.) Chemistry
B.Sc. (Hons.) Environmental Science
B.Sc. (Hons.) Microbiology

SEM - 6

DETAILED CURRICULUM

(W.E.F. 2025-26)

Sarvjanik University
Faculty of Science
Exam Scheme for B.Sc. (Hons.) Biotechnology A.Y. 2025-26

Semester - VI (2025-26)										
Sr No	Course Code	Group	Subjects	Credit	Hours / Week			CEE	SEE	Total
					Lecture	Practical	Total	Marks	Marks	Marks
1	BSMB31644	Major	Microbial Physiology and Metabolism (TH)	3	3	-	3	40	35	75
	BSMB31653		Microbial Physiology and Metabolism (PR)	1	-	1	2	10	15	25
	BSBT31645		Animal and Plant Biotechnology (TH)	3	3	-	3	40	35	75
	BSBT31654		Animal and Plant Biotechnology (PR)	1	-	1	2	10	15	25
	BSBT31646		rDNA Technology (TH)	3	3	-	3	40	35	75
	BSBT31655		rDNA Technology (PR)	1	-	1	2	10	15	25
2	BSES32639	Minor	Forest and Agriculture Pathology (TH)	3	3	-	3	40	35	75
	BSCH32640		Instrumentation Techniques of Analysis (TH)							
	BSES32641		DNA Typing (TH)							
	BSMB32642		Ferrmenter Design and Downstream Processing (TH)							
	BSES32643		Fire Safety and Audit (TH)							
	BSMB32644		Diagnostic Microbiology and Serology (TH)							
	BSES32645		Forest and Agriculture Pathology (PR)	1	-	1	2	10	15	25
	BSCH32646		Instrumentation Techniques of Analysis (PR)							
	BSES32647		DNA Typing (PR)							
	BSMB32648		Ferrmenter Design and Downstream Processing (PR)							
	BSES32649		Fire Safety and Audit (PR)							
	BSMB32650		Diagnostic Microbiology and Serology (PR)							
3	BSAS35610	SEC	Internship	4	-	4	12	50	50	100
4	BSGN34609	AEC	Professional Skills	2	2	-	2	25	25	50
	BSGN34610		Human Values and Professional Ethics (Mulya Pravah 2.0)							
		Total		**22**	**14**	**8**	**34**	**275**	**275**	**550**

Sarvjanik University
Faculty of Science
Exam Scheme for B.Sc. (Hons.) Chemistry A.Y. 2025-26

Semester - VI (2025-26)										
Sr No	Course Code	Group	Subjects	Credit	Hours / Week			CEE	SEE	Total
					Lecture	Practical	Total	Marks	Marks	Marks
1	BSES31648	Major	Pollution Chemistry and Management (TH)	3	3	-	3	40	35	75
	BSES31657		Pollution Chemistry and Management (PR)	1	-	1	2	10	15	25
	BSCH31651		Organic Chemistry-III (TH)	3	3	-	3	40	35	75
	BSCH31660		Organic Chemistry-III (PR)	1	-	1	2	10	15	25
	BSCH31652		Petrochemistry (TH)	3	3	-	3	40	35	75
	BSCH31661		Petrochemistry (PR)	1	-	1	2	10	15	25
2	BSES32639	Minor	Forest and Agriculture Pathology (TH)	3	3	-	3	40	35	75
	BSCH32640		Instrumentation Techniques of Analysis (TH)							
	BSES32641		DNA Typing (TH)							
	BSMB32642		Ferrmenter Design and Downstream Processing (TH)							
	BSES32643		Fire Safety and Audit (TH)							
	BSMB32644		Diagnostic Microbiology and Serology (TH)							
	BSES32645		Forest and Agriculture Pathology (PR)	1	-	1	2	10	15	25
	BSCH32646		Instrumentation Techniques of Analysis (PR)							
	BSES32647		DNA Typing (PR)							
	BSMB32648		Ferrmenter Design and Downstream Processing (PR)							
	BSES32649		Fire Safety and Audit (PR)							
	BSMB32650		Diagnostic Microbiology and Serology (PR)							
3	BSAS35610	SEC	Internship	4	-	4	12	50	50	100
4	BSGN34609	AEC	Professional Skills	2	2	-	2	25	25	50
	BSGN34610		Human Values and Professional Ethics (Mulya Pravah 2.0)							
		Total		**22**	**14**	**8**	**34**	**275**	**275**	**550**

Sarvjanik University
Faculty of Science
Exam Scheme for B.Sc. (Hons.) Environmental Science A.Y. 2025-26

Semester - VI (2025-26)										
Sr No	Course Code	Group	Subjects	Credit	Hours / Week			CEE	SEE	Total
					Lecture	Practical	Total	Marks	Marks	Marks
1	BSES31647	Major	Ecoinformatics (TH)	3	3	-	3	40	35	75
	BSES31656		Ecoinformatics (PR)	1	-	1	2	10	15	25
	BSES31648		Pollution Chemistry and Management (TH)	3	3	-	3	40	35	75
	BSES31657		Pollution Chemistry and Management (PR)	1	-	1	2	10	15	25
	BSES31649		Ecotourism and Entrepreneurship (TH)	3	3	-	3	40	35	75
	BSES31658		Ecotourism and Entrepreneurship (PR)	1	-	1	2	10	15	25
2	BSES32639	Minor	Forest and Agriculture Pathology (TH)	3	3	-	3	40	35	75
	BSCH32640		Instrumentation Techniques of Analysis (TH)							
	BSES32641		DNA Typing (TH)							
	BSMB32642		Ferrmenter Design and Downstream Processing (TH)							
	BSES32643		Fire Safety and Audit (TH)							
	BSMB32644		Diagnostic Microbiology and Serology (TH)							
	BSES32645		Forest and Agriculture Pathology (PR)	1	-	1	2	10	15	25
	BSCH32646		Instrumentation Techniques of Analysis (PR)							
	BSES32647		DNA Typing (PR)							
	BSMB32648		Ferrmenter Design and Downstream Processing (PR)							
	BSES32649		Fire Safety and Audit (PR)							
	BSMB32650		Diagnostic Microbiology and Serology (PR)							
3	BSAS35610	SEC	Internship	4	-	4	12	50	50	100
4	BSGN34609	AEC	Professional Skills	2	2	-	2	25	25	50
	BSGN34610		Human Values and Professional Ethics (Mulya Pravah 2.0)							
		Total		**22**	**14**	**8**	**34**	**275**	**275**	**550**

Sarvjanik University
Faculty of Science
Exam Scheme for B.Sc. (Hons.) Microbiology A.Y. 2025-26

Semester - VI (2025-26)										
Sr No	Course Code	Group	Subjects	Credit	Hours / Week			CEE	SEE	Total
					Lecture	Practical	Total	Marks	Marks	Marks
1	BSMB31644	Major	Microbial Physiology and Metabolism (TH)	3	3	-	3	40	35	75
	BSMB31653		Microbial Physiology and Metabolism (PR)	1	-	1	2	10	15	25
	BSMB31650		Medical Microbiology (TH)	3	3	-	3	40	35	75
	BSMB31659		Medical Microbiology (PR)	1	-	1	2	10	15	25
	BSBT31646		rDNA Technology (TH)	3	3	-	3	40	35	75
	BSBT31655		rDNA Technology (PR)	1	-	1	2	10	15	25
2	BSES32639	Minor	Forest and Agriculture Pathology (TH)	3	3	-	3	40	35	75
	BSCH32640		Instrumentation Techniques of Analysis (TH)							
	BSES32641		DNA Typing (TH)							
	BSMB32642		Ferrmenter Design and Downstream Processing (TH)							
	BSES32643		Fire Safety and Audit (TH)							
	BSMB32644		Diagnostic Microbiology and Serology (TH)							
	BSES32645		Forest and Agriculture Pathology (PR)	1	-	1	2	10	15	25
	BSCH32646		Instrumentation Techniques of Analysis (PR)							
	BSES32647		DNA Typing (PR)							
	BSMB32648		Ferrmenter Design and Downstream Processing (PR)							
	BSES32649		Fire Safety and Audit (PR)							
	BSMB32650		Diagnostic Microbiology and Serology (PR)							
3	BSAS35610	SEC	Internship	4	-	4	12	50	50	100
4	BSGN34609	AEC	Professional Skills	2	2	-	2	25	25	50
	BSGN34610		Human Values and Professional Ethics (Mulya Pravah 2.0)							
		Total		**22**	**14**	**8**	**34**	**275**	**275**	**550**

SARVAJANIK UNIVERSITY

INCLUSIVE | INTEGRATED | INNOVATIVE

MAJOR SUBJECTS

SEM 6

DETAILED CURRICULUM

(W.E.F. 2025-26)

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. BT		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSBT31645	**Course Name**	Animal and Plant Biotechnology (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. BT		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSBT31654	**Course Name**	Animal and Plant Biotechnology (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of faculty: Science	**Department:** Biotechnology
Program: B.Sc. (Hons) Biotechnology	**Type:** Theory + Practical
Subject: Animal and Plant Biotechnology	**Semester:** 6
Credits: 03 + 01	**Total learning hours:** 45
Course Description: This syllabus aims to provide a comprehensive understanding of plant and animal biotechnology, blending foundational knowledge with cutting-edge advancements to prepare students for research and industrial applications.	
Student Learning Outcome: Students will: 1. Recognize and remember theoretical and practical understanding of essential plant and animal cell culture methods 2. Understand applications of animal biotechnology, stem cells technology and artificial reproductive technology 3. Apply this understanding with the skills necessary for research and industrial applications 4. Analyze the knowledge of advanced techniques such as genetic transformation, genome editing (CRISPR, TALEN, ZFN), and secondary metabolite production 5. Evaluate innovative methods in plant biotechnology and crop improvement 6. Create new research methodology in animal and plant biotechnology	

Unit I: Fundamentals of Plant Tissue Culture **(07 Hours)**

1.1 Definition, History, and Scope of Plant Tissue Culture (PTC)
1.2 Laboratory Organization, Sterilization Techniques: Media, Instruments, and Explant selection
1.3 Types of Culture Media: MS and B5 Medium,
1.4 Role of Various Component and Phytohormones used in PTC Media
1.5 Micro propagation, Somatic Embryogenesis and Organogenesis

Unit-2 Advanced Techniques in Plant Tissue Culture **(07 Hours)**

2.1 Methods of Protoplast Isolation and Culture
2.2 Somatic Hybridization and its Applications in Crop Improvement
2.3 Methods of Genetic Transformation
2.4 Synthetic Seed Technology, Haploid and Double Haploid Production

Unit–3 Modern and Emerging Concepts in Plant Tissue Culture **(09 Hours)**

3.1 Introduction, Function and use of Secondary Metabolites in Plants
3.2 Germplasm Conservation and Cryopreservation
3.3 Physical and Chemical Mutagenesis in Plant Cultures
3.4 Introduction to Genome Editing Techniques
3.5 Success Stories of Commercially Viable Tissue Culture Products

Unit–4 Introduction to Animal Biotechnology **(04 Hours)**

4.1 Definition, Scope & History of Animal Biotechnology
4.2 Applications & Importance of Animal Biotechnology
4.3 Ethical Concerns & Guidelines in Animal Biotechnology

Unit–5 Animal cell culture Techniques **(12 Hours)**

5.1 Basics of Animal Cell Culture
5.2 Types of Animal Cell Cultures
5.3 Cell Culture Media, Growth Factors, and Supplements
5.4 Laboratory Requirements for Cell Culture
5.5 Aseptic Techniques and Maintenance of Cell Cultures

Unit–6 Applications of Animal Biotechnology **(06 Hours)**

6.1 Genetic Engineering in Animals (r-DNA Technology:Gene Transfer Methods, Gene Cloning, Vectors)
6.2 Animal Bioreactors (Therapeutic & Pharmaceutical Protein Production etc)
6.3 Reproductive Biotechnology
6.4 Animal Models for Research (Knockout Mice. Gnotobiotics etc)

References & Text Books:

1. S. S. Bhojwani & M.K. Razdan ,Plant Tissue Culture, Theory and Practice, a Revised Edition., Elsevier, ISBN: 9780080539096
2. H. S. Chawla, Introduction to Plant Biotechnology, 3rd Ed., Oxford & IBH Publishing Co Pvt.Ltd, ISBN: 9788120417328
3. B.D. Singh, Biotechnology, Kalyani Publishers, ISSN: 9789327220650
4. C Veeresham & CK Kokate, Medicinal plant biotechnology. CBS Publishers and Distributors; 2006. ISBN: 9788123910970
5. MK Razdan. Introduction To Plant Tissue Culture, 2/E. Oxford and IBH publishing; 2002. ISBN: 9788120417939
6. Ian Freshney, Culture of Animal Cells: A Manual of Basic techniques, 7th Edition, Wiley Blackwell, ISBN: 9781118873656
7. M.M. Ranga, Animal Biotechnology, 3rd Edition, Aros Bios, ISBN 10: 9788177543094
8. B. Singh, Textbook of Animal Biotechnology, The Energy and Resources Institute, TERI ISBN 13: 978-8179933275

Practicals:

1. Preparation of culture media and explant sterilization.
2. Inoculation of sterilized explant and Initiation of callus cultures.
3. To isolate mononuclear cells though density gradient centrifugation and perform cell viability count.
4. Maintenance of animal cell culture

Reference and Textbooks for Practical:

1. Laboratory Manual for Biotechnology. By Ashish S Verma, Surjit Das, Anchal Singh, S Chand Publishers

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. BT/MB		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSBT31646	**Course Name**	rDNA Technology (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. BT/MB		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSBT31655	**Course Name**	rDNA Technology (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of Faculty: Science	**Department**: Biotechnology
Program: B.Sc. (Hons)	**Type:** Major
Subject: rDNA Technology	**Semester:** 6
Credits: 03 + 01 = 04	
Course description: This paper introduces fundamental Recombinant DNA Technology, its tools and techniques and explains its core applications.	
Student Learning Outcomes (SLOs): At the end of the course, students will be able to: 1. Understand the Principles of rDNA Technology. 2. Explain the fundamental concepts, tools, and techniques used in recombinant DNA technology. 3. Describe the role of restriction enzymes, ligases, vectors, and host systems in gene cloning. 4. Analyse Genetic Engineering Applications 5. Evaluate the applications of rDNA technology in medicine and agriculture.	

UNIT 1: Enzymes used in rDNA Technology **(07 hrs)**

1.1 What is Gene Cloning and PCR?
1.2 Importance of Gene Cloning and PCR
1.3 Range of DNA Manipulating Enzymes
1.4 Restriction Endonucleases
1.5 Ligation Enzymes

Unit 2: Vectors for Bacteria **(08 hrs)**

2.1 Vectors: Characteristics and Types
2.2 Cloning Vectors Based on Plasmids
2.3 Cloning Vectors Based on Bacteriophage Lambda
2.4 Vectors Based on M13
2.5 Bacterial Artificial Chromosomes

Unit 3: Vectors for Eukaryotes **(07 hrs)**

3.1 Vectors for Yeasts and Other Fungi
3.2 Vectors for Higher Plants
3.3 Vectors for Animals
3.4 Human Artificial Chromosomes

Unit 4: Core Methods of rDNA Technology **(08 hrs)**

4.1 Transformation
4.2 Selection for Transformed Cells
4.3 Identification of Recombinants
4.4 Introduction of DNA in Non-bacterial Cells
4.5 Colony and Plaque Hybridization

Unit 5: rDNA Technology in Medicine and Agriculture **(07 hrs)**

5.1 Recombinant Insulin
5.2 Recombinant Vaccines
5.3 Gene Therapy for Inherited Diseases
5.4 Insect Resistant Maize
5.5 Nutritionally Improved Transgenic Plants

Unit 6: rDNA Technology in Research **(08 hrs)**

6.1 Introduction and Principle of PCR
6.2 Applications of PCR
6.3 Chain-termination DNA Sequencing
6.4 Next-Generation Sequencing
6.5 Human Genome Project

Reference:

1. Brown, T. A., Gene Cloning and DNA Analysis: An Introduction An Indian Adaptation, ISBN: 978-9354643644

Practicals:

1. Extraction of Bacterial Chromosomal DNA by Spin Column Method
2. Restriction Digestion of Phage Lambda DNA
3. Transformation by Cold $CaCl_2$ Method
4. Blue-White Screening of Recombinants

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSES31647	**Course Name**	Ecoinformatics (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSES31656	**Course Name**	Ecoinformatics (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of Faculty: Science	**Department**: Environmental Science
Program: B.Sc. (Hons)	**Type:** Major
Subject: Ecoinformatics	**Semester:** 6
Credits: 03 + 01 = 04	
Course Description: This course introduces students to the fundamental concepts of ecoinformatics and its role in ecological research.	
Student Learning Outcomes (SLOs): At the end of the course, students will be able to: 1. Understand the fundamental concepts and significance of ecoinformatics. 2. AnalyzAnalyse ecological data using computational techniques and tools. 3. Utilize GIS and remote sensing for ecological modelling and conservation planning. 4. Apply machine learning and big data analytics in ecological research. 5. Interpret and visualise ecological datasets for decision-making in environmental management.	

Unit 1: Introduction to Ecoinformatics **(07 Hours)**

1.1 Definition, scope, and significance of ecoinformatics.
1.2 Role of informatics in ecological studies and environmental science.
1.3 Overview of data types and sources in ecology.
1.4 Challenges and future trends in ecoinformatics.

Unit 2: Ecological Data Management and Analysis **(08 Hours)**

2.1 Data collection methods in ecology (field surveys, sensors, citizen science).
2.2 Data storage and management: databases and cloud computing.
2.3 Statistical and computational tools for ecological data analysis.
2.4 Open-source software for ecoinformatics (QGIS).

Unit 3: Geospatial Technologies in Ecology **(07 Hours)**

3.1 Basics of Geographic Information Systems (GIS) and Remote Sensing.
3.2 Application of GIS in ecological monitoring and species distribution modeling.
3.3 Use of drones and satellite imagery in environmental assessments.
3.4 Case studies on geospatial applications in conservation biology.

Unit 4: Ecological Modeling and Simulation **(07 Hours)**

4.1 Introduction to ecological models: types and applications.
4.2 Species distribution models (SDMs) and population modeling.
4.3 Climate change modeling and impact assessment.
4.4 Software tools for ecological modeling

Unit 5: Big Data and Machine Learning in Ecology **(08 Hours)**

5.1 Role of big data in ecological research and conservation.
5.2 Machine learning applications in biodiversity assessment.
5.3 Environmental monitoring using artificial intelligence.
5.4 Ethical considerations in ecoinformatics and AI.

Unit 6: Applications of Ecoinformatics in Sustainability **(08 Hours)**

6.1 Ecoinformatics in biodiversity conservation and natural resource management.
6.2 Ecosystem services assessment and sustainability planning.
6.3 Citizen science and participatory approaches in ecological informatics.
6.4 Policy implications and case studies on ecoinformatics applications.

Practicals:

1. **Ecological Data collection from AlgaeBase and VegBank datasets.**
2. **GIS and Remote Sensing Applications**: Hands-on exercise on habitat mapping using QGIS and Google Earth Engine.
3. **Species Distribution Modelling (SDM)**: Predicting species habitats using MaxEnt and interpreting results.
4. **Machine Learning in Ecology**: Applying supervised learning techniques for ecological data classification.

References:

1. Kindlmann, P. (2019). *Ecoinformatics: A Handbook of Data Science, Ecology, and Conservation*. Springer.
2. Gotelli, N. J., & Ellison, A. M. (2013). *A Primer of Ecological Statistics*. Sinauer Associates.
3. Franklin, J. (2010). *Mapping Species Distributions: Spatial Inference and Prediction*. Cambridge University Press.
4. Guisan, A., Thuiller, W., & Zimmermann, N. E. (2017). *Habitat Suitability and Distribution Models with Applications in R*. Cambridge University Press.
5. Elith, J., & Leathwick, J. R. (2009). *Species Distribution Models: Ecological Explanation and Prediction Across Space and Time*. Annual Review of Ecology, Evolution, and Systematics, 40, 677–697.

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSES31649	**Course Name**	Ecotourism and Entrepreneurship (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSES31658	**Course Name**	Ecotourism and Entrepreneurship (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of Faculty: Science	**Department**: Environmental Science
Program: B.Sc. (Hons)	**Type:** Major
Subject: Ecotourism and Entrepreneurship	**Semester:** 6
Credits: 03 + 01 = 04	

Course Description:

This course provides an understanding of the principles and concepts of ecotourism and eco-entrepreneurship. It also helps in exploring the sustainable business models in ecotourism and their economic, social, and environmental impacts.

Student Learning Outcomes (SLOs):

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

1. Explain the fundamentals of ecotourism and eco-entrepreneurship.
2. Analyze case studies of successful eco-enterprises and ecotourism destinations.
3. Design and develop a sustainable ecotourism business plan.
4. Evaluate the impact of ecotourism on biodiversity, local communities, and the economy.
5. Demonstrate knowledge of policies, laws, and best practices governing ecotourism.
6. Apply sustainable practices in tourism operations and eco-businesses.

Unit 1: Introduction to Ecotourism **(07 Hours)**

1.1 Definition, Scope, and Principles of Ecotourism
1.2 Evolution of Ecotourism
1.3 Differences between Mass Tourism and Ecotourism
1.4 Key Stakeholders in Ecotourism

Unit 2: Sustainable Tourism and Conservation **(08 Hours)**

2.1 Environmental Impacts of Tourism
2.2 Ecological and Cultural Sustainability in Tourism
2.3 Protected Areas, Biodiversity, and Ecotourism
2.4 Role of Community-Based Tourism

Unit 3: Eco-Entrepreneurship and Business Models **(08 Hours)**

3.1 Concepts and Characteristics of Eco-Entrepreneurship
3.2 Identifying Eco-Business Opportunities
3.3 Sustainable Business Strategies in Tourism
3.4 Case Studies of Successful Eco-Entrepreneurs

Unit 4: Policy, Regulations, and Certification in Ecotourism **(07 Hours)**

- 4.1 Global and National Policies on Ecotourism
- 4.2 Certification Systems (Green Globe, LEED, Ecotourism Certification)
- 4.3 Ethical Considerations and Responsible Tourism
- 4.4 Role of Governments and NGOs in Promoting Ecotourism

Unit 5: Planning and Managing Ecotourism Businesses **(08 Hours)**

- 5.1 Destination Planning and Management
- 5.2 Ecotourism Infrastructure and Facilities
- 5.3 Marketing Strategies for Eco-businesses
- 5.4 Financial and Operational Management

Unit 6: Future Trends and Challenges in Ecotourism **(07 Hours)**

- 6.1 Technological Innovations in Ecotourism
- 6.2 Climate Change and Tourism Adaptation
- 6.3 Challenges in Implementing Sustainable Tourism
- 6.4 Opportunities for Future Eco-Entrepreneurs

Experiments:

1. Ecotourism Site Assessment: Conducting a sustainability audit of a local tourism site
2. Business Plan Development for an Eco-Enterprise
3. Reviewing policies related to ecotourism in Gujarat
4. Developing promotional materials (posters, brochures, digital content) for Sustainable Tourism Marketing Project

References:

1. Weaver, D. (2006). "Sustainable Tourism: Theory and Practice." Routledge.
2. Honey, M. (2008). "Ecotourism and Sustainable Development." Island Press.
3. Wearing, S., & Neil, J. (2009). "Ecotourism: Impacts, Potentials and Possibilities." Elsevier.
4. Buckley, R. (2010). "Conservation Tourism." CABI.

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/CH		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSES31648	**Course Name**	Pollution Chemistry and Management (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/MB		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSES31657	**Course Name**	Pollution Chemistry and Management (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of Faculty: Science	**Department**: Environmental Science
Program: B.Sc. (Hons)	**Type:** Major
Subject: Pollution Chemistry and Management	**Semester:** 6
Credits: 03 + 01 = 04	

Course Description:

This course provides fundamental knowledge of pollution chemistry, including sources and impacts of environmental pollutants. It also explores scientific principles behind pollution monitoring and its control techniques.

Student Learning Outcomes (SLOs):

After completing this course, students will be able to:

1. Understand the chemistry of pollutants and their interactions in air, water, and soil.
2. Analyze environmental pollutants using modern techniques and interpret results.
3. Assess the impact of pollution on human health and ecosystems.
4. Evaluate pollution control technologies and management strategies.
5. Apply knowledge of pollution chemistry in environmental monitoring and sustainable management.

Unit 1: Fundamentals of Pollution Chemistry **(07 Hours)**

1.1 Definition and types of pollution (air, water, soil, noise, radioactive, thermal, etc.).
1.2 Sources and classification of pollutants.
1.3 Chemical properties and transformations of pollutants.
1.4 Definition and classification of persistent organic pollutants (POPs).
1.5 Xenobiotic chemicals and their impact on the environment.

Unit 2: Air Pollution Chemistry **(08 Hours)**

2.1 Composition of the atmosphere and major air pollutants.
2.2 Chemical reactions in the atmosphere (smog formation, acid rain, ozone depletion, greenhouse gases).
2.3 Noise pollution: sources, effects on human health and ecosystems.
2.4 Monitoring techniques for air and noise pollution.
2.5 Control measures and abatement technologies.

Unit 3: Water Pollution Chemistry **(07 Hours)**

3.1 Properties of water and sources of water pollution.
3.2 Types of water pollutants (organic, inorganic, heavy metals, microbial, emerging contaminants).
3.3 Eutrophication, biomagnification, and waterborne diseases.
3.4 Wastewater treatment methods (physical, chemical, and biological treatment).

Unit 4: Soil and Hazardous Waste Pollution **(07 Hours)**

4.1 Soil contamination sources and pollutant interactions.
4.2 Industrial and agricultural pollution (pesticides, fertilizers, heavy metals, plastics).
4.3 Hazardous waste classification, disposal, and remediation techniques.
4.4 Sustainable soil management strategies.

Unit 5: Polymer Chemistry and Pollution **(08 Hours)**

5.1 Chemistry and environmental impact of plastics, rubber, and silicon-based materials.
5.2 Microplastics and their ecological consequences.
5.3 Recycling, degradation, and sustainable alternatives.
5.4 Case studies on polymer pollution management.

Unit 6: Radioactive Pollution and Pollution Management **(08 Hours)**

6.1 Sources of radioactive pollution (nuclear plants, medical waste, natural sources).
6.2 Effects of radiation on human health and the environment.
6.3 Pollution control technologies and emerging innovations.
6.4 Waste minimization, circular economy, and sustainable practices.
6.5 National and international environmental policies and regulations.
6.6 Environmental impact assessment (EIA) and risk analysis.

Practicals:

1. Measurement of particulate matter ($PM_{2.5}$ & PM_{10}) and gaseous pollutants (SO_2, NOx) using air quality monitoring devices.
2. Determination of pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), and chemical oxygen demand (COD) in water samples.
3. Analysis of heavy metals (Chromium, Iron, Aluminum, Nickel) in soil using spectrophotometric techniques.
4. Analysis of Na^+ / K^+ using a flame photometer.
5. Detection of silica using spectrophotometric method.

References:

1. Manahan, S. E. (2017). *Environmental Chemistry*. CRC Press.
2. Connell, D. W. (2005). *Basic Concepts of Environmental Chemistry*. CRC Press.
3. Baird, C., & Cann, M. (2012). *Environmental Chemistry*. W. H. Freeman.
4. De, A. K. (2012). *Environmental Chemistry*. New Age International Publishers.
5. Peavy, H. S., Rowe, D. R., & Tchobanoglous, G. (1985). *Environmental Engineering*. McGraw Hill.

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences			
Faculty	Science	**Program**	B.Sc. CH
Year	3	**Version**	3
Semester	VI	**Effective From**	July 2025
Course Code	BSCH31651	**Course Name**	Organic Chemistry-III (TH)

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences			
Faculty	Science	**Program**	B.Sc. CH
Year	3	**Version**	3
Semester	VI	**Effective From**	July 2025
Course Code	BSCH31660	**Course Name**	Organic chemistry-III (PR)

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Department: Chemistry	
Program: B.Sc.	**Type:** Theory + Practical (NEP-2020-NEW)
Subject: Major: Organic Chemistry-3	**Semester:** 6
Credit: (3T + 1P)	**Total learning hours**: (45 T + 30 P) Hrs
Course description: The major course Organic Chemistry 3 is infused with the details of reaction mechanism, polynuclear hydrocarbons, large heterocyclic systems. A comprehensive understanding of these topics will be developed by taking examples of representative members of each class. The chemical synthesis, properties and reactions of these compounds will be discussed in detail. This course will also discuss some of the key applications of each class of compounds in diverse fields. In addition to this course will give insights of photochemistry and pericyclic reaction. Course will cover important area including reaction mechanism.	
Student learning outcome: Learner will: • Get the knowledge on various reaction mechanisms through correlation with the fundamental properties of the reactants • Be able to recognize various reaction mechanisms like SN^1, SN^2, SN^i, E_1, E_2, E_1-CB etc. • Become familiar with their particular properties, chemical reactions, criterion of aromaticity with reference to polynuclear hydrocarbons and heterocyclic compounds • Understand about the photochemical reactions • Be able to understand the molecular origin of pericyclic reactions, understand the concept of interaction of organic compounds with light and subsequently trigger the reaction	

Unit-1 Heterocyclic Compounds-II **(07 Hrs)**

1.1 Introduction

1.2 Condensed five membered heterocycles: Synthesis, reactivity, aromatic character and importance of following heterocyclic rings:

1.2.1 Indole, Benzofuran, Thionaphthene

1.3 Condensed six membered heterocycles: Synthesis, reactivity, aromatic character and importance of following heterocyclic rings:

1.3.1 Quinoline, Isoquinoline

Unit-2 Polynuclear Compounds-II **(07 Hrs)**

2.1 Introduction and classification

2.2 Linear ortho fused polynuclear hydrocarbons: Synthesis and importance

2.2.1 Tetracene, Pentacene, Hexacene

2.3 Non-linear ortho fused polynuclear hydrocarbons: Synthesis and importance

2.3.1 Benzanthracene, Dibenzanthracene, Benzphenanthrene

2.4 Carcinogenic polycyclic compounds

Unit-3 Reaction Mechanism-I **(07 Hrs)**

3.1 Recapitulation

3.1.1 Different types of organic reaction – addition, substitution, elimination and rearrangement – oxidations and reductions

3.1.2 Homolytic and heterolytic fission of bond and reactive intermediates

3.1.3 Acid base character of organic compounds

3.1.4 Classification of reagents

3.2 Nucleophilic substitution – SN1, SN2 reactions and affecting factors

3.3 Mixed SN1 and SN2 and SET mechanism

Unit-4 Reaction Mechanism-II **(08 Hrs)**

4.1 The E2, E1 and E1cB mechanisms

4.2 Hoffman and Saytzeff modes of elimination

4.3 Orientation of the double bond, reactivity effects of substrate structures, attacking base, the leaving group and the medium, pyrolytic elimination

4.4 Reactivity of carbonyl group, nucleophilic addition of hetero-atoms (N,O)

Unit-5 Pericyclic Reaction **(08 Hrs)**

5.1 Classification of pericyclic reactions

5.2 Three approaches: Evidence for the concertedness of bond making and breaking

5.4 Symmetry-allowed and symmetry -forbidden reactions

5.5 The wood ward -Hoffmann rules

5.6 The Aromatic Transition structure [Huckel & Mobius]

Unit-6 Photochemistry **(08 Hrs)**

6.1 Basic principle

6.2 Different types of electronic transition in organic molecule

6.3 Laws of photo chemistry

6.4 Type of photo chemical reactions

6.5 Photo chemistry of carbonyl compounds, alkenes (Norrish I, Norrish II cleavages)

6.6 Photo rearrangements

Laboratory practical **(30 Hrs)**

Organic Separation of binary mixture (Minimum five):

1) A+P

2) A+B

3) P+B

4) B+N

5) N+N

Reference books:

Theory references:

1. Organic Chemistry, Volume-1,2, I.L.Finar, 6 th Edn., 2002, , Pearson
2. Advance Organic Chemistry, Arun Bahl and B S Bahl, 2012, S.Chand
3. Text Book of Organic Chemistry, P.S. Kalsi, 1999, Macmillan India Limited
4. Advance Organic Chemistry, S. Chand, 1987, S. Chand Publication
5. Advanced Organic Chemistry Part A and Part B, Carey B. F. A., Sundberg R.J., 5th Edition, 2007, Springer.
6. Organic Chemistry, Morrison, R.T., Boyd, R.N., 6th Edition, 2011, Prentice- Hall of India, New Delhi, 2011.

Laboratory references:

1. Vogel, A.I. Quantitative Organic Analysis, Part 3, ,2012, Pearson
2. Practical Organic Chemistry, Mann, F.G. & Saunders, B.C., 2009, Pearson Education

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences			
Faculty	Science	**Program**	B.Sc. CH
Year	3	**Version**	3
Semester	VI	**Effective From**	July 2025
Course Code	BSCH31652	**Course Name**	Petrochemistry (TH)

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences			
Faculty	Science	**Program**	B.Sc. CH
Year	3	**Version**	3
Semester	VI	**Effective From**	July 2025
Course Code	BSCH31661	**Course Name**	Petrochemistry (PR)

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of faculty: Dr. Hemangi Desai	**Department:** Chemistry
Program: B.Sc. (Semester-VI)	**Type:** Theory **(NEP-2020-NEW)**
Subject: DSE-VI- Petrochemistry	
Credit: 03 (T)	**Total learning hours: 45**

Course description: This Course Paper proposes to teach about:

1. The scope, methodology and application of modern Petrochemical Science.
2. Theoretical and practical concepts of instruments that are commonly used-in most Petrochemical Science field.
3. Plan and conduct scientific experiments and record the results of such experiments.
4. How Petrochemical Science is useful to solve social, economic and environmental problem and issues facing our society in energy, medicine, and health.
5. Develop and design optimized operation for petroleum and petrochemical products and processes.

Student learning outcome: After completing this course, the students will be able to learn:

1. Basic principles and concepts of petrochemistry
2. Knowledge of fuels and petroleum industries
3. Apply basic concepts in formation and mining of petroleum
4. Recognize composition and classification of petroleum
5. Classify various operations & processes carried out in petroleum refinery
6. Use basic quality monitoring and laboratory test

Unit 1: Basics of Petroleum Industry **(06 Periods)**

1.1 Definition of Petroleum and Petrochemicals
1.2 International Petroleum Scenario
1.3 National natural gas and petroleum scenario
1.4 Development of Indian Petroleum Industry

Unit 2: Petroleum Gases **(06 Periods)**

2.1 Associated gas, Casing head gas, Dissolved gas, Refinery off gas,
2.2 Liquefied petroleum gas (LPG), Compressed natural gas (CNG), Liquefied natural gas (LNG).
2.3 Advantages and disadvantages of petroleum.
2.4 Commonly used crude oil terms like WTI, Brent and OPEC.

Unit 3: Theories of Petroleum **(08 Periods)**

3.1 Theories on origin of petroleum: Inorganic
3.2 Theories on origin of petroleum: Organic
3.3 Stages and Organic source material for the formation of petroleum
3.4 Detection of petroleum

Unit 4: Chemistry and Composition of Petroleum: **(06 Periods)**

4.1 Composition and Characteristics of Petroleum
4.2 Classification of Petroleum
4.3 Physical and chemical properties of petroleum
4.4 Importance of petrochemical industry

Unit 5: Refinery Operation **(08 Periods)**

5.1 Pretreatment of oil
5.2 Mining of petroleum
5.3 Refining of crude oil
5.4 Products obtained and their uses

Unit 6: Petrochemical Technology **(10 Periods)**

6.1 How do Refiners increase the yield of Gasoline?
6.2 Synthetic Gasoline
6.3 Knocking and Prevention of Knocking
6.4 Octane Rating & Cetane Number

Text books:

1. Petroleum refining and Petrochemical. N. K. Sinha, Umesh Publication Delhi
2. Advance Petrochemical, Dr. G. N. Sarkar, Khanna Publication. Delhi
3. Textbook on Petrochemical, Dr. B. K. Bhaskararao, Khanna Publication, Delhi
4. Introduction to petrochemical, Sukumar Maiti
5. Fuels and combustion, Samir Sarkar, Orient Longman Ltd. Hyderabad
6. Modern Petroleum Refining Processes, B.K. Bhaskara Rao, Oxford and IBH Publication, New Delhi

Reference Books:

1) Chemistry of petrochemical processes 2nd edition by Sami Matar , Lewis F. Hatch Gulf publishing company
2) Fundamentals of Petroleum and Petrochemical Engineering by Uttam Ray Chaudhuri CRC press
3) Hand book of petroleum Processing Edited by David S. J. "Stan" Jones and Peter R. Pujado Springer
4) The Chemistry and technology of Petroleum 4th edition by James G. Speight CRC Press
5) Advance Petroleum Refining, Dr. G. N. Sarkar, Khanna Publication, Delhi
6) Petroleum Refining technology, Dr. Ram Prasad, Khanna Publication, Delhi
7) Chemical From Petroleum, A.L. Waddms, Murry, London
8) Modern Petroleum Technology. G. D. Hobson, John Wily, Chichester

Chemistry Lab-Semester-VI

1. Determination of flash point of petroleum sample by Abels closed cup apparatus.
2. Determination of flash point of petroleum sample by Pensyky Martin apparatus.
3. Determination of density and specific gravity of given petroleum sample.
4. Determination of smoke point of given petroleum sample.
5. Determination of aniline point of given petroleum sample
6. Determination of diesel index of given petroleum sample
7. Determination of viscosity by redwood viscometer I apparatus.

Reference Books:

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

2. Laboratory Manual on Engineering Chemistry, S.K. Bhasin and Sudha Rani, 3rd Edition, Reprint 2011, Dhanpat Rai Publishing Company (P) Ltd.

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. MB/BT		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSMB31644	**Course Name**	Microbial Physiology and Metabolism (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. MB		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSMB31653	**Course Name**	Microbial Physiology and Metabolism (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Microbial Physiology and Metabolism

Name of faculty: Science	**Department:** Microbiology
Program: B.Sc Microbiology Sem-6	**Type:** Major
Subject: Microbial Physiology and Metabolism	
Credit: 4	**Total learning hours:** 45

Course description:

Microbial Physiology is a concentrated course with the goal of integrating microbial biochemistry and physiology to enhance the understanding of the microbial cell and the diverse nature of various life processes, which provides opportunity to re-address the learning about general scientific conceptions. The paper emphases metabolic processes used by bacteria for generation of energy. It mainly covers the study of various chemoorganotrophic, chemolithotrophic and phototrophic metabolic processes found in various microbes

Student learning outcome:

- Students shall understand the basic principles and concepts of microbial metabolism and shall gain knowledge of the energy generating mechanisms in microbes with various metabolic processes.
- To better understand the basic concepts and principles about microbial metabolism.
- To acquire knowledge, explore and get acquainted with different metabolic processes.

UNIT 1 Microbial Metabolism		**(Duration: 7 Hrs)**
1.1	Important, principles and concepts of metabolism	
1.2	Metabolic role of ATP	
1.3	Oxidation and Reduction reactions	
1.4	Electron Transport chain	
UNIT 2 Introduction to Chemolithotrophs and Phototrophs		**(Duration: 8 Hrs)**
2.1	Metabolism of Chemolithotrophs	
2.2	Metabolism of Phototrophs	

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Unit 3 Transport of Biomolecules		**(Duration: 6 Hrs)**
3.1	Properties of Biomolecules	
3.2	Transport of molecules	
Unit 4 Enzymes and Reactions of life		**(Duration: 8 Hrs)**
4.1	Characteristics and structure of enzymes	
4.2	Enzyme nomenclature, Co-factors, enzyme substrate reactions of life	
4.3	Location of enzyme and regulation of enzyme activity	
Unit 5 Metabolism of Chemoorganotrophs Part I		**(Duration: 8 Hrs)**
5.1	Respiration: Aerobic and Anaerobic	
5.2	Pathways: EMP, ED and PPP	
5.3	Cycles : TCA and Glyoxylate Bypass	
5.4	Electron Transport Chain, and Oxidative Phosphorylation	
5.5	Fermentation	
Unit 6 Metabolism of Chemoorganotrophs Part II		**(Duration: 8 Hrs)**
6.1	Catabolism of Carbohydrates other than glucose	
6.2	catabolism of Protein and Amino acid	
6.3	catabolism of Lipids	
6.4	Principles governing Biosynthesis and CO2 fixation	

List of Practical

1. Estimation of Reducing Sugar by Cole's method
2. Estimation of Protein by Folin Lowrys method
3. Determination of Thermal Death Time (TDT)
4. Determination of Thermal Death Point (TDP)

References

1. Willey Sherwood woolverton . Mc Graw Hill International Edition. Prescotts Microbiology 10th edition (2017) ISBN 978—981-3151-26-0
2. Marjorie Kelly Cowan Heidi Smith Microbiology A systems approach: 5th edition ISBN 978-1-259-92194
3. Berg, Jeremy M, Tymoczko, JohnL., Stever, Lubert Biochemistry 6th edition Published by W.H Freemaan. (2006) ISBN 0716787245
4. Rastogi P.D. Sharma Microbiology 4th edition (2020) ISBN9788193887585
5. Robert K Murray, Daryl K Granner, Victor W Rodwekk Harpers Illustrated Biochemistry. 27th Edition Mc Graw Hill (2006). ISBN 007-125301-7(India)

Further Reading:

- U. Satyanarayana, U Chakrapani Biochemistry 5th edition Elesvier (2020) ISBN 978-8131262535

J.L.Jain , Sunjay Jain, Nitin Jain Fundamentals of Biochemistry S.Chand Publishing (1979). 9788121924535

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. MB		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSMB31650	**Course Name**	Medical Microbiology (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. MB		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSMB31659	**Course Name**	Medical Microbiology (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Medical Microbiology

Name of faculty: Science	**Department:** Microbiology
Program: B.Sc Sem 6	**Type:** Major
Subject: Medical Microbiology	
Credit: 04	**Total learning hours:** 45

Course description:

The major part covered in this paper contains the topics related to human health. It includes the understanding for microbial diseases. The subject includes the diseases caused by bacteria, viruses, fungi and protists. Another major learning is Introduction to Epidemiology and hospital acquired infections. It also includes the control and Prevention of Hospital-Associated Infections.

Student learning outcome:

- To make them aware about the Pathogenicity and Infection of various pathogens.
- To enhance the knowledge related to microbial diseases.
- They will learn about the various diseases caused by bacteria, viruses, fungi and Protists.
- Students will learn about the various Epidemiology of Hospital-Associated Infections.
- To learn about Control and Prevention of Hospital-Associated Infections.

Unit-1: Pathogenicity and Infection **(Duration: 4 Hrs)**

1.1 Pathogenicity and infectious disease.

1.2 Virulence.

1.3 Exposure and transmission.

Unit-2: Human Diseases caused by Bacteria **(Duration: 9 Hrs)**

2.1 Airborne Disease: Mycobacterium.

2.2 Arthropod borne Disease: Plague.

2.3 Direct contact Disease: STD (Syphilis)

2.4 Food borne and waterborne Disease: *Escherichia coli* Gastroenteritis.

2.5 Zoonotic Disease: Anthrax

2.6 Opportunistic Disease: Streptococcal Pneumonia.

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Unit-3: Human Diseases caused by Viruses **(Duration: 9 Hrs)**

3.1 Airborne Disease: Influenza

3.2 Arthropod borne Disease: Chikungunya, Coronavirus Disease 2019 (COVID-19)

3.3 Direct contact Disease: AIDS

3.4 Food borne and waterborne Disease: Gastroenteritis (Viral)

3.5 Zoonotic Disease: Rabies

Unit-4: Human Diseases caused by Fungi and Protists **(Duration: 9 Hrs)**

4.1 Airborne Disease: Cryptococcosis

4.2 Arthropod borne Disease: Malaria

4.3 Direct contact Disease: Sporotrichosis and Trichomoniasis

4.4 Food borne and waterborne Disease: Amebiasis

4.6 Opportunistic Disease: Aspergillosis

Unit-5: Epidemiology of Hospital-Associated Infections. **(Duration: 6 Hrs)**

5.1 Factors affecting development of Hospital-Associated Infections.

5.2 Common Hospital-Associated Infections.

5.3 Microbiology of Hospital-Associated Infections.

5.4 Sources of infection.

Unit-6: Control and Prevention of Hospital-Associated Infections. **(Duration: 6 Hrs)**

6.1 Role of microbiology in surveillance and control.

6.2 Breaking the chain of infection.

6.3 Prevention and Control

6.3 Appropriate use of antibiotics.

SARVAJANIK UNIVERSITY

INCLUSIVE | INTEGRATED | INNOVATIVE

MINOR SUBJECTS

SEM 6

DETAILED CURRICULUM

(W.E.F. 2025-26)

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences			
Faculty	Science	**Program**	B.Sc. ES/BT/MB/CH
Year	3	**Version**	3
Semester	VI	**Effective From**	July 2025
Course Code	BSMB32644	**Course Name**	Diagnostic Microbiology and Serology (TH)

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences			
Faculty	Science	**Program**	B.Sc. ES/BT/MB/CH
Year	3	**Version**	3
Semester	VI	**Effective From**	July 2025
Course Code	BSMB32650	**Course Name**	Diagnostic Microbiology and Serology (PR)

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Diagnostic Microbiology and Serology

Name of faculty: Science	**Department:** Microbiology
Program: B. Sc Sem-6	**Type:** Minor
Subject: Diagnostic Microbiology and Serology	
Credit: 4	**Total learning hours:**45
Course description: The main aim of the subject is to inform the knowledge about human microbe interactions, collection and Processing of Clinical Specimens and laboratory diagnosis of various microbial diseases. Serology course has been added to convey basic information about immune system development. Also included antigen & antibody in detail. Topics included like Ag-Ab reactions will help the students to know latest diagnostic methods.	
Student learning outcome: At the end of the course, the students will get knowledge of • Epidemiological studies • Hospital Acquired Infection • Disease-causing bacteria and microbiological examination of different clinical samples to find the cause. • Antimicrobial Sensitivity Test to find drug of choice • Basic aspects of immunity, antigens, antibodies • Immune system and the cells involved, which are routinely estimated in different diseases • Performance of various antigen-antibody reactions	

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)
- Prescott's Microbiology, Willey, Sandman & Wood., 12th edition, McGraw Hill. (ISBN: 9781265123031)
- Chakraborty P. Text book of Microbiology, 3rd ed., New central book agency (ISBN: 9788173818769)
- Dulsy Fatima (2014), Immunology, Saras publication (ISBN:9789382459880)

Unit-1: Human-microbe interactions **(Duration: 08 Hrs)**

1.1 Normal flora of human body

1.2 Epidemiology and epidemiological methods

1.3 Nosocomial infections: Source, mode of transmission and prevention

1.4 Emerging and Re-emerging infectious disease and pathogens

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Unit-2: Causative Agents, Pathogenesis and Laboratory diagnosis of Bacterial Disease

(Duration: 08 Hrs)

2.1 Urinary Tract Infection

2.2 Respiratory Tract Infection: Diphtheria; Pertussis; Pneumonia

2.3 Gastrointestinal Diseases: Typhoid; Diarrhoea and Food Poisoning

2.4 Sexually Transmitted Disease: Syphilis; Gonorrhea

Unit-3: Collection and Processing of Clinical Specimens **(Duration: 08 Hrs)**

3.1 Collection, Transportation and Examination of Clinical specimen: Urine, Sputum, Pus, Faeces, Blood, CSF

3.2 Collection, Transportation and Examination of Clinical specimen for Viral Diseases

3.3 Collection, Transportation and Examination of Clinical specimen for Fungal Diseases

3.4 Antimicrobial Sensitivity Test: Disc Diffusion and MIC

Unit-4: Immunity and immune system **(Duration: 07 Hrs)**

4.1 Introduction, Definition, Classification of Immunity

4.2 Innate immunity: Types and Mechanisms

4.3 Acquired immunity: Types and Mechanisms

4.4 Cells of immune system

Unit-5: Antigen & Antibody **(Duration: 07 Hrs)**

5.1 Types of Antigen- Haptens and Epitopes

5.2 Factors determining antigenicity

5.3 Antibodies: Characteristics, Functions, Structure & Types of immunoglobulin

5.4 Monoclonal Antibodies and their production

Unit-6: Antigen-Antibody reaction **(Duration: 07 Hrs)**

6.1 Mechanism and Factors affecting antigen –antibody reactions.

6.2 Precipitation and Agglutination Reaction

6.3 Immunochromatographic Technique

6.4 ELISA and RIA

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

List of Practical

1. Slide test for typhoid
2. Slide test for syphilis
3. ICT/Dot immunoassay/ Flow through assay for HIV Antibody.
4. Antimicrobial sensitivity test: Kirby-Bauer method.
5. Determination of MIC by tube dilution method.

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences				
Faculty	Science	**Program**	B.Sc. ES/BT/MB/CH	
Year	3	**Version**	3	
Semester	VI	**Effective From**	July 2025	
Course Code	BSES32641	**Course Name**	DNA Typing (TH)	

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences				
Faculty	Science	**Program**	B.Sc. ES/BT/MB/CH	
Year	3	**Version**	3	
Semester	VI	**Effective From**	July 2025	
Course Code	BSES32647	**Course Name**	DNA Typing (PR)	

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of Faculty: Science	**Department**: Environmental Science
Program: B.Sc. (Hons)	**Type:** Minor
Subject: DNA Typing	**Semester:** 6
Credits: 03 + 01 = 04	
Course Description: This course provides an introductory understanding of DNA markers and their use in polymorphism detection in forensic sciences. It also discusses techniques and instruments involved in this.	
Student Learning Outcomes (SLOs): At the end of this course, students will be able to: 1. To have knowledge of the molecular basis of DNA differences. 2. To understand use of DNA sequence diversity in DNA typing. 3. To relate various DNA typing techniques. 4. To analyze outcomes of methods like RFLP, STR analysis and mtDNA typing. 5. Evaluate procedures involved in DNA extraction, quantification, amplification (PCR), and electrophoresis. 6. To create reports of case studies related to DNA typing.	

Unit 1: Introduction to DNA as Evidence **(07 Hours)**

1.1 Polymorphism and DNA Polymorphism
1.2 Human DNA Polymorphic Markers
1.3 History of DNA Polymorphism Profiling in Forensics
1.4 Tissues as Sources of DNA

Unit 2: Techniques of DNA Profiling-1 **(07 Hours)**

2.1 Methods of DNA extraction
2.2 Slot Blot Assay for DNA Quantification
2.3 Fluorescent Intercalating Dye Assay
2.4 Basic Principles of Polymerase Chain Reaction

Unit 3: Techniques of DNA Profiling-2 **(08 Hours)**

3.1 Basic Principles of Electrophoresis
3.2 Supporting Matrices for Electrophoresis
3.3 Apparatus for Electrophoresis and Forensic Applications
3.4 Fluorescent Intercalating Dye Staining
3.5 Detection Methods for PCR-Based Assays

Unit 4: Variable Number Tandem Repeat (VNTR) Profiling **(07 Hours)**

- 4.1 Restriction Fragment Length Polymorphism
  - 4.1.1 Restriction Endonuclease Digestion
  - 4.1.2 Southern Transfer
  - 4.1.3 Hybridization with Probes
  - 4.1.4 Detection
- 4.2 Amplified Fragment Length Polymorphism

Unit 5 : Autosomal STR and mtDNA Profiling **(08 Hours)**

- 5.1 Characteristics of STR Loci
- 5.2 STR Loci Commonly Used for Forensic DNA Profiling
- 5.3 Forensic STR Analysis
- 5.4 *Amelogenin* Locus
- 5.5 mtDNA Polymorphic Regions
- 5.6 mtDNA Screen Assay

Unit 6: Forensic DNA Databases and QC **(08 Hours)**

- 6.1 History of Forensic DNA Databases
- 6.2 Infrastructure of CODIS
- 6.3 Indexes of CODIS
- 6.4 Routine Database Searches for Forensic Investigations
- 6.5 Familial Search Strategies
- 6.6 Laboratory Accreditation and Validation

Practicals:

1. Demonstration and theoretical case study of mitochondrial DNA analysis.
2. Characterization of DNA by electrophoresis
3. Case studies of results and interpretation of DNA Profiles.
4. Visit to Forensic Science Laboratory.

References:

1. Forensic Biology by Richard Li, CRC Press. ISBN: 978-1032098791.

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/BT/MB/CH		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSMB32642	**Course Name**	Fermenter Design and Downstream Processing (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/BT/MB/CH		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSMB32648	**Course Name**	Fermenter Design and Downstream Processing (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

FERMENTER DESIGN AND DOWNSTREAM PROCESSING

Name of Faculty: Sciences	**Department:** Microbiology
Program: B.Sc. (Hons) Sem 6	**Type:** Minor
Subject: Fermenter Design and Downstream Processing	
Credit: 4	**Duration:** 45 hours
Course description: This course provides an in-depth understanding of fermenter design principles, types of fermenters, and downstream processing techniques. It covers reactor engineering, optimization of fermentation parameters, product recovery, and industrial effluent treatment.	
Learning Outcomes: By the end of the course, students will be able to: • Explain the principles of fermenter design and design parameters. • Analyze microbial kinetics and optimize fermentation conditions. • Apply downstream processing techniques for product purification. • Understand industrial effluent treatment and waste valorization. • Evaluate real-world applications of fermentation in various industries.	

Unit 1: Introduction to Fermenter Design (6 Hours)

1.1 Fundamentals of Fermentation Technology
1.2 Ideal Design and Construction of a Fermenter
1.3 Design Criteria for Fermenters: Aeration, Agitation, pH & Temperature Control
1.4 Materials of Construction & Sterilization Considerations

Unit 2: Types of Fermenters (9 Hours)

2.1 CSTF, Column and Fluidized Bed Fermenter
2.2 The Waldhof-type Fermenter
2.3 The Tower Fermenter
2.4 Air-lift Fermenters
2.5 The deep-jet Fermenter
2.6 The Packed Tower

Unit 3: Introduction to Downstream Processing (7 Hours)

3.1 Introduction to Recovery of Fermentation Products
3.2 Solid-Liquid Separation Methods: Filtration, Centrifugation, Sedimentation
3.3 Cell Disruption Techniques: Mechanical, Chemical, Enzymatic, and Physical Methods

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences				
Faculty	Science		**Program**	B.Sc. ES/BT/MB/CH
Year	3		**Version**	3
Semester	VI		**Effective From**	July 2025
Course Code	BSES32643	**Course Name**	Fire Safety and Audit (TH)	

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences				
Faculty	Science		**Program**	B.Sc. ES/BT/MB/CH
Year	3		**Version**	3
Semester	VI		**Effective From**	July 2025
Course Code	BSES32649	**Course Name**	Fire Safety and Audit (PR)	

Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
1	0	0	1	10	15	25

Name of Faculty: Science	**Department**: Environmental Science
Program: B.Sc. (Hons)	**Type:** Minor
Subject: Fire Safety and Audit	**Semester:** 6
Credits: 03 + 01 = 04	

Course Description: This course provides an in-depth understanding of industrial safety standards and regulations.

1. To understand fire chemistry, fire hazards, and fire prevention strategies.
2. To study fire safety regulations, codes, and standards.
3. To explore fire detection, suppression, and emergency response systems.
4. To develop skills in conducting fire safety audits and risk assessments.
5. To analyze case studies and best practices in fire safety management.

Student Learning Outcomes (SLOs):

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

1. Identify fire hazards and apply appropriate fire prevention measures.
2. Implement fire safety standards and compliance regulations.
3. Operate and maintain fire detection and suppression systems.
4. Conduct fire safety audits and risk assessments effectively.
5. Develop fire emergency response and evacuation plans.

Unit 1: Fundamentals of Fire and Fire Chemistry (7 Hours)

1.1 Fire triangle and tetrahedron concepts.
1.2 Types of fires and their classifications.
1.3 Combustion process and fire behavior.
1.4 Common fire hazards in industrial, commercial, and residential settings.

Unit 2: Fire Prevention and Protection Measures (7 Hours)

2.1 Fire prevention principles and risk reduction strategies.
2.2 Fire-resistant materials and construction techniques.
2.3 Fire load calculation and fire zoning.
2.4 Electrical and chemical fire hazards and their mitigation.

Unit 3: Fire Detection and Suppression Systems (8 Hours)

1. Fire detection devices (smoke detectors, heat detectors, flame detectors).
2. Fire suppression systems (sprinklers, gas-based suppression, foam systems).
3. Fire extinguishers: types, selection, and usage.
4. Maintenance and testing of fire protection systems.

Unit 4: Fire Safety Regulations and Compliance (8 Hours)

1. National and international fire safety standards (NFPA, NBC, OSHA).
2. Fire safety laws and building codes.
3. Role of government agencies and fire departments.
4. Fire insurance and legal liabilities.

Unit 5: Fire Safety Audit and Risk Assessment (7 Hours)

1. Principles of fire safety audits and their importance.
2. Fire risk assessment techniques and hazard analysis.
3. Fire drill planning and emergency preparedness.
4. Documentation and reporting in fire safety audits.

Unit 6: Emergency Planning and Fire Response Management (8 Hours)

1. Evacuation procedures and fire escape planning.
2. Roles and responsibilities during a fire emergency.
3. Disaster management and post-fire recovery measures.
4. Case studies on major fire incidents and lessons learned.

Practical Components: (4 Practicals)

1. **Fire Extinguisher Handling and Demonstration:**
   - Hands-on training on different types of fire extinguishers.
   - Practical application of fire suppression techniques.
2. **Fire Safety Audit and Risk Assessment:**
   - Conducting a fire safety audit in an institutional or industrial setting.
   - Identifying fire hazards and recommending corrective actions.
3. **Fire Detection and Alarm System Demonstration:**
   - Understanding the working of smoke, heat, and flame detectors.
   - Testing and maintenance of fire alarm systems.
4. **Emergency Evacuation and Fire Drill Simulation:**
   - Planning and executing a fire evacuation drill.
   - Role-playing different emergency response scenarios.

Suggested References:

1. Kumar, S. (2020). *Fire Safety and Prevention Engineering*. XYZ Publishers.
2. Gupta, R. (2018). *Fire Safety Management Handbook*. McGraw-Hill.
3. NFPA (2019). *National Fire Protection Association Codes and Standards*.
4. NBC (2020). *National Buildin.g Code of India – Fire Safety Provisions*.
5. Fire Safety Institute (2021). *Principles of Fire Risk Assessment in Buildings*.

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences							
Faculty	Science			**Program**	B.Sc. ES/BT/MB/CH		
Year	3			**Version**	3		
Semester	VI			**Effective From**	July 2025		
Course Code	BSES32639	**Course Name**	Forest and Agriculture Pathology (TH)				
Teaching Scheme				**Examination Scheme**			
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**	
3	3	0	0	40	35	75	

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences							
Faculty	Science			**Program**	B.Sc. ES/BT/MB/CH		
Year	3			**Version**	3		
Semester	VI			**Effective From**	July 2025		
Course Code	BSES32645	**Course Name**	Forest and Agriculture Pathology (PR)				
Teaching Scheme				**Examination Scheme**			
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**	
1	0	0	1	10	15	25	

Name of Faculty: Science	**Department**: Environmental Science
Program: B.Sc. (Hons)	**Type:** Minor
Subject: Forest and Agricultural Pathology	**Semester:** 6
Credits: 03 + 01 = 04	
Course Description: This course aims to develop understanding of the fundamental concepts of plant pathology in forest and agricultural systems. It also explores the causes, symptoms, and impact of plant diseases and their management.	
Student Learning Outcomes (SLOs): At the end of the course, students will be able to: 1. Identify major plant diseases affecting forest and agricultural crops. 2. Understand the role of fungi, bacteria, viruses, and environmental factors in plant pathology. 3. Assess different plant disease management strategies, including biological and chemical control. 4. Develop skills in diagnosing plant diseases and recommending sustainable solutions. 5. Apply knowledge of plant-microbe interactions in forestry and agricultural productivity.	

Unit 1: Introduction to Plant Pathology **(07 Hours)**

1.1 Definition, scope, and history of plant pathology.
1.2 Major diseases affecting forest and agricultural crops.
1.3 Economic and ecological significance of plant diseases.

Unit 2: Pathogens and Disease Development **(07 Hours)**

2.1 Types of plant pathogens: fungi, bacteria, viruses, nematodes.
2.2 Disease cycle, epidemiology, and environmental factors.
2.3 Host-pathogen interactions and disease resistance mechanisms.

Unit 3: Forest Pathology **(08 Hours)**

3.1 Major tree diseases: root rots, cankers, leaf spots, wilts.
3.2 Role of fungi and bacteria in forest ecosystems.
3.3 Disease management in natural and planted forests.

Unit 4: Agricultural Crop Diseases **(08 Hours)**

4.1 Major diseases of cereals, pulses, fruits, and vegetables.
4.2 Disease diagnosis and symptoms.
4.3 Integrated pest and disease management (IPDM) strategies.

Unit 5: Disease Control and Management **(07 Hours)**

5.1 Biological, chemical, and cultural control methods.
5.2 Use of resistant crop varieties and biotechnology.
5.3 Quarantine measures and legal regulations.

Unit 6: Recent Advances in Plant Pathology **(08 Hours)**

6.1 Role of molecular biology in plant disease management.
6.2 Climate change and emerging plant diseases.
6.3 Biotechnological approaches: genetic engineering and disease forecasting.

Practicals:

1. Isolation and identification of fungal and bacterial pathogen on PDA and NA plates. (Sugarcane and Citrus canker)
2. Microscopic identification of plant pathogenic fungi.
3. Evaluation of fungicide efficacy by measuring fungal growth inhibition.
4. Preparation of disease herbarium and photographic documentation.

References:

1. Agrios, G. N. (2005). *Plant Pathology*. Academic Press.
2. Mehrotra, R. S., & Aggarwal, A. (2017). *Plant Pathology*. Tata McGraw-Hill.
3. Singh, R. S. (2002). *Introduction to Principles of Plant Pathology*. Oxford & IBH Publishing.
4. Manion, P. D. (1991). *Tree Disease Concepts*. Prentice Hall.
5. Sharma, P. D. (2011). *Plant Pathology*. Rastogi Publications.

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/BT/MB/CH		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSCH32640	**Course Name**	Instrumentation Techniques of Analysis (TH)			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
3	3	0	0	40	35	75

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. ES/BT/MB/CH		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSCH32646	**Course Name**	Instrumentation Techniques of Analysis (PR)			
Teaching Scheme				**Examination Scheme**		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Term end examinations (SEE)	Total
1	0	0	1	10	15	25

Name of Faculty: Dr. Hemangi Desai	**Department: Chemistry**
Program: B.Sc.	**Semester:** VI
Subject: MINOR : INSTRUMENTATION TECHNIQUES OF ANALYSIS	**Type:** Theory
Credit: 03 (T) + 01 (P)	**Total learning hours: 45**
Course description: This Course Paper proposes to teach about: various instrumental techniques i.e. electro-analysis, spectroscopy and chromatography analysis required in different area of instrumental analysis.	
• **Student learning outcome:** After completing this course, the students will be able to learn: 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: pH meter, Potentiometer, Ion Selective Electrodes, Conductivity meter, Colorimeter, Flame Photometer, Ion Exchange and Ion Exclusion Chromatography, Chemical Sensors and Biosensors	

UNIT 1	**pH metric Measurements**	**(06 Hours)**
1.1	Concept of pH and pH Range	
1.2	pH Indicator and colour key	
1.3	Principle of pH Measurement and Glass Electrode	
1.4	Applications of pH Meter	

UNIT 2	**Electrometric analysis**	**(06 Hours)**
2.1	Principle, Instrumental set up and Applications	
2.1.1	Potentiometer	
2.1.2	Ion Selective Electrodes	
2.1.3	Conductivity meter	

UNIT 3	**Absorption Spectroscopy**	**(09 Hours)**
3.1	Introduction: EMR regions, Energy changes, Concept of colour wheel	
3.2	Principle of Colorimeter	
3.3	Instrumental set up of Colorimeter: Source, Intensity control, Sample Holder, Monochromator, Detector and Read out Device	
3.4	Advantages, Disadvantages and Applications of Colorimeter	

UNIT 4	**Emission Spectroscopy**	**(09 Hours)**
4.1	Principle of Flame Photometer and Process in a Flame	
4.2	Instrumental set up of Flame Photometer: Sample Introduction, Nebulizer, Spray Chamber, Flame Excitation Unit-Burner System, Spectral Isolator, Monochromator, Filter, Detector and Read out System	
4.3	Procedure of Flame Photometer	
4.4	Applications of Flame Photometer	
4.5	Limitations of Flame Photometer	

UNIT 5 **Ion Exchange Chromatography** **(09 Hours)**

5.1 Ion exchangers – types, characteristics and properties
5.2 Ion exchange equilibrium and factors affecting it
5.3 Instrumental set up of IEC- columns and detector
5.4 Principle, procedure and applications of IEC

UNIT 6 **Sensors** **(06 Hours)**

6.1 Definition and classification of sensors, Signal and noise
6.2 Efficiency of sensors, sensitivity and limit of detection
6.3 Solid state electrode & Mass sensitive sensors
6.4 Optical sensors & Thermal sensors
6.5 Biosensors & Biocatalytic biosensors

Reference Books:

1. Principles of Instrumental Analysis , D.A. Skoog, F.J. Holler, and S.R. Crouche, 11th Edition, 2012, Cengage Learning
2. Instrumental Methods of Analysis, H.H. Willard, L.L. Meritt and J.A. Dean,7th Edition 1 st Edition, 1986, CBS Publishers
3. Analytical Instrumentation, G. Currell, 1st Edition, 2002, (1st Reprint, 2010) , Wiley India
4. Handbook of Analytical Instruments, R.S. Khandpur, 2nd Edition, 2006,(3rd Reprint, 2008) Tata Mc Graw Hill publications
5. Instrumental Methods of Analysis, B.K. Sharma, 24th Edition, 2005, Krishna Prakashan.

6.Instrumental Methods of Chemical Analysis, H. Kaur,8th Edition,2012, Pragati Prakashan
7.Environmental Chemistry, H. Kaur, 9th Edition, 2015, Pragati Prakashan

LABORATORY PRACTICALS

1.To determine divalent metal ion (Fe+2) of water sample.
2.To determine trivalent metal ion (Al+3) of water sample.
3.To determine hexavalent metal ion (Cr+6) of water sample.
4.To determine monovalent anion (NO2 -1) of water sample.
5.To determine divalent anion (SO4 -2) of water sample.
6.To determine trivalent anion (PO4 -3) of water sample.

SARVAJANIK UNIVERSITY

INCLUSIVE | INTEGRATED | INNOVATIVE

ABILITY ENHANCEMENT COURSE (AEC) SUBJECTS SEM 6

DETAILED CURRICULUM

(W.E.F. 2025-26)

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. (All)		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSGN34610	**Course Name**	Human Values and Professional Ethics (Mulya Pravah 2.0)			
Teaching Scheme				**Examination Scheme**		
Credits	Lecture (L)	Tutorial (T)	Practical (P)	Continuous Assessments (CCE)	Term end examinations (SEE)	Total
2	2	0	0	25	25	50

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Human Values and Professional Ethics (*Mulya Pravah 2.0*)

Name of Faculty: Sciences	**Department:** All
Program: B.Sc. (Hons)	**Type:** AEC
Subject: Human Values and Professional Ethics (*Mulya Pravah 2.0*)	
Credit: 02	**Total teaching hours: 30**
Course description: This course on "Mulya Pravah" creates a new paradigm towards an equitable world for all. It draws upon the innate space of universal values within individuals and communities to plan and implement strategic change and generate measurable results. It develops the capacity of individuals, groups, and communities to look within themselves to source their inner potential and universal values to ensure that their actions enable justice and equity for all. It strengthens them to envision new patterns and leverages systemic and cultural change and economic and social transformation, through equitable actions.	
Learning Outcomes: By the end of the course, students will be able to: • Understand India's rich cultural legacy and human values of which we are the custodians. • Focus on professional ethics, which help citizens to discern desirable and undesirable actions • Understand constitutional values, universal values, and holistic education to create integrated citizens.	

Reference:

- Blanchard, Kenneth and Peale, Norman Vincent. 1988. The Power of Ethical Management. New York: William Morrow and Company, Inc.
- Gandhi, Mohandas Karamchand. 1971. Pathway to God compiled by MS Deshpande. Ahmedabad: Navajivan Mudranalaya, Navjivan Trust.
- Kashyap, Subhash C. 2019 .Constitution of India. A handbook for students. New Delhi: National Book Trust.
- Lama, D. 1999. Ethics for the New Millennium. New York: Riverhead Books
- Lama, D. 2012. Beyond Religion: Ethics for a Whole World. India: Harper Collins.
- Mahadevan, B., Bhat, V.R. and Nagendra, P.R.N. 2022. Introduction to Indian Knowledge System. Delhi: PHI.
- Niti Shatak, Chaukhamba Prakashan, Varanasi
- Rodriguez, S. and Juvva, S. 2018. Embodying Universal Values and Ethical Leadership in Higher Education: Creating Change Agents for Social Transformation. In B. Chatterjee, A. Banerji and P. Arya (Eds.). Resolution to Resolve: Sustainability Practices in Industry and Education. New Delhi: Bloomsbury [ISBN: 978-938-74-7168-9].

Sarvajanik University
Faculty of Science
B.Sc. (Hons)

Unit-1: Introduction to Indian Ethos **(07 Hours)**

1.1 Meaning of ethos and cultural essence of India

1.2 Scriptures as the base of the Indian Knowledge System (IKS)

1.3 Integrating the two methodologies: interiorization process for self-exploration, and exterior scientific pursuit for the prosperity of world

1.4 The Law of Karma and Nishkama Karma (The Law of action and selfless action)

Unit-2: Human Values and Ethics **(08 Hours)**

2.1 Knowing the Self and the universal values that we stand for. This is self enquiry & self discovery.

2.2 Background conversations and deep listening, recognizing the assumptions that we make the biases we have, and the implications for ethical action.

2.3 Self-identity: distinguishing and embracing oneself (and others) four profiles (inner potential, social, professional, personality)

2.4 Distinguish ideology, perspectives beliefs from embodying values.

Unit-3: Constitutional Values and Global Citizenship **(07 Hours)**

3.1 Values embedded in the Preamble of the Indian Constitution Integration of Human Rights and duties

3.2 Directive principles and responsibilities as citizens of India

3.3 Sensibility and responsibilities towards global environment, Loksangraha and Vasudhaiva Kutumbakam.

Unit-4: Integrated Personality and Well-being **(08 Hours)**

4.1 The three gunas (qualities of sattva—purity and harmony, rajas —activity and passion, tamas —darkness and chaos), the four antah-karanas (inner instruments), and panch kosha (five sheaths).

4.2 Stress management: meditated personality and agitated personality.

4.3 Oneness, non-duality, and equanimity

4.4 Physical, mental, social, and spiritual well-being

****

Name of College: Shree Ramkrishna Institute of Computer Education and Applied Sciences						
Faculty	Science		**Program**	B.Sc. (All)		
Year	3		**Version**	3		
Semester	VI		**Effective From**	July 2025		
Course Code	BSGN34609	**Course Name**	Professional Skills			
Teaching Scheme				**Examination Scheme**		
Credits	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Continuous Assessments (CCE)**	**Term end examinations (SEE)**	**Total**
2	2	0	0	25	25	50

Name of Faculty: Science	Department: All
Program: UG	Type: AEC- 6
Subject: Professional Skills	

Credit: 02	Total Learning Hours: 30 Hours

The Objectives are to help learners

- Acquire career skills and fully pursue to partake in a successful career path
- Prepare a good résumé
- Prepare for interviews and group discussions
- Understand the significance of Team Skills
- Acquire Team Skills
- Design, develop, and adapt to situations as an individual and as a team member

Student Learning Outcome:

After completion of the course the student will be able to

- Prepare their résumé on an appropriate template without grammatical and other errors andusing proper syntax.
- Actively participate in group discussions towards gainful employment.
- Perform appropriately and effectively in group discussions.
- Explore and Identify career opportunities.
- Demonstrate a set of non-cognitive skills such as empathy, creativity, teamwork, and collaboration, for the smooth and efficient functioning at a workplace.
- Actively use and operate online team communication tools, such as: Webinar, Skype, Zoom,Google, and Hangout.
- Demonstrate a set of cognitive skills and non-cognitive skills such as critical thinking, problem-solving, ability tolearn for maintaining good interpersonal relations, smooth and efficient functioning at a workplace, empathy, creativity and teamwork skills.

Unit -1

1.1 Résumé Skills: Preparation and Presentation **(03 hours)**

- Introduction of Résumé and Related Terms
- Importance of Preparing a Good Résumé
- Difference between a CV, Résumé, and Biodata
- Essential Components of a Good Résumé

1.2 Résumé Skills: Common Errors

- Common Errors
- Guidelines for Résumé Preparation

Unit -2

2.1 Interview Skills: Preparation and Presentation **(06 hours)**

- Meaning of Interview
- Types of Interviews

- STAR Approach for Facing an Interview

2.2. Interview Procedure

- Dos and Don'ts
- Important Questions Generally Asked in a Job Interview

2.3 Interview Skills: Common Errors

- Common Errors
- Interview Questions for Assessing Your Strengths and Weaknesses

2.4 Simulation

- Job Simulation Formats
- Comment Critically on Simulated Interviews

2.5 Demonstrate an Ideal Interview

Unit – 3

3.1 Meaning and Importance of a Group Discussion (GD) **(06 hours)**

- Meaning of a Group Discussion
- Importance of a Group Discussion
- Types of Group Discussions.

3.2 Procedure of a Group Discussion

- Methodology
- Ground Rules
- Evaluation of a Group Discussion

3.3 Group Discussion: Common Errors

3.4 Group Discussion: Simulation

Unit – 4

4.1 Process of Career Exploration **(03 hours)**

- Knowing Yourself — Personal Characteristics
- Knowledge about the World of Work, Requirements of Jobs Including Self-employment.
- Sources of Career Information
- Preparing for a Career Based on Potentials of Learners and Availability of Opportunities

Unit –5

5.1 Cognitive Skills: Meaning, types of cognitive skills, strategies to develop cognitive skills. **(06 hours)**

- Critical Thinking Skills.
- Problem-solving Skills
- Ability to Learn.

5.2 Non-cognitive Skills

- Empathy
- Creativity
- Teamwork
- Collaboration
- Resilience

- Interpersonal skills
- Perseverance
- Social Control
- Social Skill

Unit – 6

6.1 Presentation: Meaning and Types **(6hours)**

- Meaning of Presentation
- Types of Presentations
- Presentation for Internal and External Communication
- Presentation Strategies
- Ways to Improve Presentation Skills Over Time

Recommended Reading:

1. Plomin, R. (1999). Genetics and general cognitive ability, Nature, 402, C25-C29.
2. Plomin, R. & Von Stumm, S. (2018). The new genetics of intelligence, Nature Reviews Genetics, 19 (3): 148-159.
3. Mumford, M. D., Todd, E. M., Higgs, C. & McIntosh, T. (2017). Cognitive skills and leadership performance: The nine critical skills, The Leadership Quarterly, 28(1): 24-39.
4. Welsh, J. A., Nix, R. L., Blair, C., Bierman, K. L. and Nelson, K. E. (2010). The Developmentof cognitive skills and gains in academic school readiness for children from low-incomefamilies, J Educ Psychol. 102(1): 43–53.
5. Nickerson, R.S. (1999). "Enhancing Creativity" ed. Sternberg, R.J. *Handbook of Creativity*, Cambridge University Press.
6. Snee, R. D. (2001). "Dealing with the Achilles Heel of Six Sigma—Project Selection Is the Key to Success," *Quality Progress* 66–72.
7. Scholtes, P. R., Joiner, B. L. and Streibel, B. J. (2003). *The Team Handbook*, 3rd ed. (Madison,WI: Joiner Associates.
8. Ibid.
9. GOAL/QPC & Joiner Associates, *The Team Memory Jogger* (Madison, WI: 1996).
10. Doyle, M. and Straus, D. (1982). *How to Make Meetings Work;* New York: Jove Books.
11. Snee, R. D., Kelleher, K. H. and Reynard, S. (May 1998). "Improving Team Effectiveness," *Quality Progress,* 43–48.
12. Hoerl, R. and Snee, R. (2012). *Statistical Thinking: Improving Business Performance, Second Edition* Copyright ©
13. Berber, N., Slavić, A. and Aleksić M. (2020). Relationship between perceived teamwork effectiveness and team performance in banking sector of Serbia, *Sustainability, 12*(20), 8753 (https://doi.org/10.3390/su12208753)
14. Gutman, L. M., & Schoen, I. (2013). The Impact of Non-Cognitive Skills on Outcomes for Young People (pp. 1-5). London: Education Endowment Foundation. Leading Educationand Social Research.

15. Megargee, E. I. (1966). Undercontrolled and overcontrolled personality types in extreme antisocial aggression. *Psychological Monographs: General and Applied, 80*(3), 1–29. https://doi.org/10.1037/h0093894

16. Kjøbli, John and Ogden, Terie (2014). A randomized effectiveness trial of individual child social skills training: Six-month follow-up, Child and Adolescent Psychiatry and MentalHealth 8 (31)

17. Driskell, J. E., Salas, E. & Driskell, T. (2018). Foundations of teamwork and collaboration. American Psychologist, 73 (4), 334-338. (https:/doi.org/10.1037/amp0000241)

Web links

1. https://www.edubloxtutor.com/what-are-cognitive-skills/
2. https://mybrainware.com/cognitive-skills/cognitive-skills-foundation-for-learning/

https://www.thebalancecareers.com/cognitive-skills-definition-and-examples-2063736

3. https://www.rungila.com/en/cognitive_skill
4. https://news.harvard.edu/gazette/story/2015/03/smarter-by-the-minute-sort-of/
5. https://en.wikipedia.org/wiki/Cognitive_skill
6. https://www.indeed.com/career-advice/career-development/cognitive-skills-how-to- improve-them
7. https://www.skillsyouneed.com/ips/problem-solving.html/

Videos

1. https://www.youtube.com/watch?v=k-8K9IksLh8
2. https://youtu.be/y0FtXhSu0J0
3. https://youtu.be/RuQjYzP9PMo
4. https://youtu.be/4ET3SvXJyhw
5. https://youtu.be/FXJUDyqobbM
6. https://youtu.be/UzPMMSKfKZQ
7. https://youtu.be/EGvI1BTCm5w
8. https://www.youtube.com/watch?v=E2jYdEO18nU Self Control: Teaching Students About Their Greatest Inner Strength with Nathan DeWall-
9. https://www.youtube.com/watch?v=mZUTZKbe4hI Self control is the key to success. Lessons from the Marshmallow Test
10. https://www.youtube.com/watch?v=4StLXX1k_9I How Instant Gratification is HarmingSociety and What to Do About It | John Davidson | TEDxCSUS
11. https://www.youtube.com/watch?v=E2jYdEO18nU Self Control: Teaching Students About Their Greatest Inner Strength with Nathan DeWall-
12. https://www.youtube.com/watch?v=mZUTZKbe4hI Self control is the key to success. Lessons from the Marshmallow Test
13. https://www.youtube.com/watch?v=4StLXX1k_9I How Instant Gratification is HarmingSociety and What to Do About It | John Davidson | TEDxCSUS
14. https://www.youtube.com/watch?v=lw_2qDIeV8s How To Develop Self-Control To CreateAn Amazing Life"