SIES

College of Arts, Science & Commerce

RISE WITH EDUCATION

Sion(West), Mumbai – 400022.

(Autonomous)

Faculty: Science

Program : B.Sc

PROGRAM OUTCOMES
AND
COURSE OUTCOMES

This is to certify that page nos 1 to 107 of this document are verified and found to be correct.

SIES COLLEGE OF ARTS, SCIENCE & COMMERCE (AUTONOMOUS) MUMBAI 400 022

Principal
SIES College of Arts, Science & Commerce (Autonomous)
Sion (West), Mumbai - 400 022.

SIES College of Arts, Science and Commerce, Autonomous,
Sion west, Mumbai

Name of the Programme: BACHELOR OF SCIENCE (B.Sc.)
(Three years Integrated Degree Programme)

The B.Sc. Programme Outcomes

SIES offers a three years integrated degree programme in Science-B.Sc. with specialization in various domains.

The Programme outcomes (POs) are skills and competencies that a learner is expected to attain on completion of the program. The B.Sc. POs include domain-dependent skills, subject knowledge and global skills and competencies that prepare learners for progression to higher studies, employability and citizenship. A student of the B.Sc. programme should be able to demonstrate the attainment of these skills for the award of the qualifying degree.

The POs are well aligned with the Institutional Vision and Mission. They are framed to ensure that the learning levels and academic standards of B.Sc. programmes are comparable with that of the other higher education institutes across the nation and globe. The teaching methodologies focus on instruction delivery in a learner-centric environment to fulfil the institutional learning objectives and groom a well-integrated personality in its learners.

Table1: Program Outcomes of the B.Sc. Program
On completion of the B.Sc. Program, our graduate is expected to have attained following skills, attitudes and competencies.
PO1. Solving Complex Problems Apply the knowledge gained in breaking down complex problems into simple components; and to design processes required for problem solving.
PO2.Critical Thinking and reasoning ability Cultivate critical thinking based on rationale to identify assumptions, verify the accuracy and validity of assumptions, and make decisions based on reasoning.
PO3. Reasoning ability and Rational thinking Instill the ability of logical reasoning to question the rationale behind concepts, ideas, and perspectives to draw logical conclusions.
PO4. Research Aptitude Utilize and integrate research-based knowledge in an interdisciplinary framework; apply research tools for analysis and interpretation of data; understand and comply with research ethics.
PO5. Effective Communication skill: Demonstrate the ability to listen and to clearly express ideas verbally. Equip to write reports and make presentations effectively.
PO6. Information and Digital Literacy: Equip to use appropriate tools and techniques inclusive of internet and electronic media for acquiring, assessing and analysing data from diverse resources.
PO7. Social Interactive Skills and team work: Exhibit networking and social interactive skills; function effectively as an individual and as a member in diverse groups; demonstrate leadership quality useful for employability.

PO8. Self-directed and Lifelong Learning: Ability to explore and gain knowledge in independent and self-reliant ways. Demonstrate ability to adapt and upgrade with the global , social and technological changes.
PO9. Awareness towards Environment and Sustainable Development: Exhibit awareness and a concern for environmental issues; understand and realize the significance of cohabitation and co-evolution in attaining the needs of sustainable development.
PO10. Gender Sensitization and Civic Engagement Respect gender sensitivity, gender equity and gender justice; encourage mutual understanding and express empathetic social concern towards different value systems and different strata of society with respect to civic duties.

Structure of the B.Sc. Programme:

The B.Sc. Program is structured in 6 semesters and is offered with the following specializations.
For detailed Syllabus, please refer to Academics-Courses and Syllabus.

A) B.Sc. - Single Major (Aided Programs)

Group 1

1. B.Sc. Botany
2. B.Sc. Microbiology
3. B.Sc. Zoology
4. B.Sc. Chemistry

Group 2

5. B.Sc. Mathematics
6. B.Sc. Physics
7. B.Sc. Statistics

B) B.Sc. - Double Major

1. B.Sc. Biochemistry and Botany
2. B.Sc. Biochemistry and Zoology
3. B.Sc. Biochemistry and Microbiology
4. B.Sc. Biochemistry and Chemistry

C) B.Sc. – Self-Financed Programs

1. B.Sc. Biotechnology
2. B.Sc. Computer Science
3. B.Sc. Information Technology

Table 2: Structure of the B.Sc. Programme

Program	First Year B.Sc. Semester1 and 2	Second Year B.Sc. Semester3 and 4	Third Year B.Sc. Semester5 and 6
B.Sc. Single	7 theory courses and 3 practical courses in each	7 theory courses and 2 practical courses in each	5 theory courses and 3 practical courses in each

Major **Aided**	semester. (Any 3 subjects of choice from the 7 subjects listed in A) above and One compulsory subject - Foundation Course.)	semester. (Any two subjects of choice from subjects studied in First Year and One compulsory subject - Foundation Course)	semester. (Any one subject of choice from subjects studied in Second Year, and One course in Applied component)
B.Sc. Double Major **Aided**	7 theory courses and 3 practical courses in each semester. (Any 3 subjects of choice from the 7 subjects listed in A) above including at least one subject from Group1 and one compulsory subject - Foundation Course)	7 theory courses and 2 practical courses in each semester. (Any two subjects of choice from subjects studied in First Year, including at least one subject from Group1 and One compulsory subject - Foundation Course)	5 theory courses and 3 practical courses in each semester. (Subject1: Biochemistry, Subject2: Any one subject from the Group 1 that was studied in Second Year, and One course in Applied component)
BSc. **Self-Financed**	**BT and CS** 7 theory courses and 3 practical courses as mentioned in the syllabus in each semester. **IT** 5 theory courses and practical courses as mentioned in the syllabus in each semester.	**BT and CS** 7 theory courses and 3 practical courses as mentioned in the syllabus in each semester. **IT** 5 theory courses and practical courses as mentioned in the syllabus in each semester.	**BT and CS** 5 theory courses and 3 practical courses as mentioned in the syllabus in each semester. **IT** 5 theory courses and practical courses as mentioned in the syllabus in each semester.

Principal

SIES College of Arts, Science and Commerce (Autonomous)

Sion west

Program: BSc Biochemistry

(Double Majors with Biochemistry as an interdisciplinary subject at third year of BSc)

Class: TYBSc

(3 Units Biochemistry)

Program Outcomes

Program Specific Outcomes

Course Outcomes

Overall Credit Structure for T.Y. B.Sc (3+3 Units; Double Majors)

Semester	Major 1	Major 2	Applied Component	Credits/Semester	Degree/ cumulative credits
V	8C	8C	4C	20C	**BSc Double Majors (3+3 units) 40 Credits**
VI	8C	8C	4C	20C	
Total Credits	16C	16C	8C	40C	

Major 1: Biochemistry
Major 2: Microbiology/ Botany/ Zoology/ Chemistry
Applied Component: Fishery Biology/Drugs & dyes/ Horticulture

Credit Structure of courses offered by Biochemistry department for T. Y. B.Sc. Biochemistry (3+3 Units; Double Majors)

Name of the Program: B.Sc. Double Majors (3+3 Units)
Name of Department: Biochemistry

Class	Semester	Course Code	Course Title	Credits	No. of lectures/ week	Marks
TYBSc	V	SIUSBCH51	Nutrition, Biomolecules & Biophysical Chemistry- I	2.5	4	100
		SIUSBCH52	Physiology, Metabolism & Applied Biochemistry- I	2.5	4	100
		SIUSBCHP5	Practical of course SIUSBCH51 & SIUSBCH52	3	8	100
TYBSc	VI	SIUSBCH61	Nutrition, Biomolecules & Biophysical Chemistry- II	2.5	4	100
		SIUSBCH62	Physiology, Metabolism & Applied Biochemistry- II	2.5	4	100
		SIUSBCHP6	Practical of course SIUSBCH61 & 62	3	8	100

SI: SIES
U: Undergraduate
S: Science stream
BCH: Biochemistry

Dr. Deepali Kothekar
Head-Dept. of Biochemistry

POs, PSOs and COs for TYBSc Biochemistry (3 Units) syllabus for BSc Double Majors with Biochemistry

The characteristic graduate attributes comprising of Programme Outcomes, Programme Specific Outcomes and Course Outcomes for a science graduate in the subject of Biochemistry are as follows:
Abbreviations used:
PO: Programme Outcome, PSO: Programme Specific Outcome, CO: Course Outcome
Cognitive Levels:- R: Remember, U: Understand, Ap: Apply, An: Analyze, E: Evaluate, C: Create

Serial Number	**Details of Programme Outcomes (POs)**
PO1	**Academic competence and problem-solving ability** • Understand fundamental concepts and gain in-depth disciplinary knowledge • Apply the knowledge of various courses learned under the program to solve societal issues and problems. • Recognize and appreciate the scope and applications of the discipline of study *Cognitive levels*: *R, U, Ap*
PO2	**Critical Thinking and Analytical skills** • Develop critical thinking and a sense of inquiry or asking relevant scientific questions • Demonstrate the ability to analyse, interpret and draw conclusions from qualitative/quantitative data • Critically evaluate ideas, theories and concepts by following scientific and interdisciplinary approach *Cognitive levels: U, An, Ap*
PO3	**Research Aptitude** • Utilizing the contextual knowledge in an inter-disciplinary framework. • Integrating research based knowledge and research methods involving problem definition, analysis and interpretation of data, synthesis of the information to provide valid conclusions. • Exercising analytical skill, research ability, creativity, for employability and collaborating with industries. *Cognitive levels: A, An, E, C*
PO4	**Effective Communication Skills** • Demonstrate the ability to listen, analyse and reproduce the instructions. • Express thoughts and ideas effectively through written and oral communication. • Demonstrate skills to present complex information in a clear, lucid and concise manner. *Cognitive levels: Ap, C*
PO5	**Proficiency with Information and Communication Technology** • Use e-resources for effective learning. • Employ computational tools and internet to retrieve, analyse, present, communicate and disseminate scientific data and information • Understand the scope and limitations of printed and electronic media in gathering, and disseminating scientific knowledge. *Cognitive levels: Ap, An, E*

PO6	**Personal and behavioral competence** • Demonstrate conversational competence through effective communication and interaction with peers and seniors • Exhibit time management while completing tasks in classroom and laboratory • Exhibit adaptability, team building and leadership qualities as a member of diverse groups • Demonstrate the ability to work independently and responsibly • Demonstrate awareness towards issues related to environment, sustainability, and gender equity *Cognitive levels: U, Ap, An, C*

Serial Number	**Details of Programme Specific Outcomes (PSOs)**
PSO1	**Academic Competence and problem-solving ability** • Imbibe disciplinary knowledge and understand fundamental concepts of biology, chemistry and biochemistry • Demonstrate coherent understanding of structure and functions of biomolecules • Explain biochemical processes and underlying mechanisms • Apply the concepts and mechanisms of metabolic and information pathways to solve problems related to human health and nutrition • Recognize and appreciate the scope and applications of biochemistry in diverse fields such as pharmaceutical, biopharmaceutical, agriculture, food and nutrition, forensic, genetic engineering and tissue engineering. *Cognitive levels: R, U, Ap, An*
PSO2	**Critical thinking and analytical skills** • Develop critical thinking and a sense of inquiry for asking relevant questions in the discipline of biochemistry • Demonstrate the ability to analyse, interpret and draw conclusions from qualitative/quantitative data • Critically evaluate ideas, theories and concepts by following scientific approach and an open minded and reasoned perspective. *Cognitive levels: U, An, E*
PSO3	**Experiential learning and Laboratory Skills** • Follow and create standard operating procedures and Good Laboratory Practices • Understand the principles and working of laboratory equipments • Develop laboratory skills and qualities required for successful career in teaching, research, industry, etc. • Apply the analytical and laboratory skills in deeper understanding of life processes and in finding solutions for issues and problems related to biochemistry • Analyse and evaluate the existing processes, methods and techniques employed in biochemistry and related disciplines *Cognitive levels: R, U, Ap, An, C*

PSO4	**Research Aptitude and Interdisciplinary Approach** • Demonstrate a sense of inquiry and capability for identifying problems related to health, food and nutrition, agriculture, etc. • Articulate research problems or questions with an interdisciplinary approach • Apply the principles of research design • Employ research methods and tools for analysis and interpretation of data • Employ computational tools in overcoming challenges related to applications of biochemistry • Demonstrate awareness of research ethics, research policies and laws related to copy rights, Intellectual Property Rights, plagiarism, use of animals in research, and accessing research resources. *Cognitive levels: Ap, An, E, C*

Evaluation: Student's understanding of biochemistry will be evaluated through a combination of examinations, quizzes, Problem solving ability, laboratory reports, & class participation. These assessments are designed to gauge learner's comprehension of both theoretical concepts and practical applications.

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Course Outcomes for TYBSc Biochemistry (3 Units)

Course code: SIUSBCH51 **Course Title:** Nutrition, Biomolecules & Biophysical Chemistry- I

The study of this course will accomplish the following outcomes:

Unit	Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
Unit 1:1.1.1	CO1**:** *Discuss concepts in nutrition and express the physiological significance of components of nutrition*	R, U	PO1, PO4/ PSO1
1.1.2	CO2: *Compute calorific value, RQ, BMR and deduce their significance*	U, An, Ap	PO1, PO2 /PSO1, PSO2
1.2	CO3: *Describe the structure and properties of carbohydrates, proteins and nucleic acids and correlate them with their biochemical role*	R, U, Ap	PO1, PSO1
Unit 2:	CO3: *Describe the structure and properties of carbohydrates, proteins and nucleic acids and correlate them with their biochemical role*	R, U, Ap	PO1, PSO1
Unit 3:	CO3 *Describe the structure and properties of carbohydrates, proteins and nucleic acids and correlate them with their biochemical role*	R, U, Ap	PO1, PSO1
	CO4 *Classify enzymes, discuss enzyme kinetics and recognize their importance*	R,U,E	PO1, PO4/ PSO1,PSO2
Unit 4	CO5 *Employ techniques of Chromatography and Spectroscopy in biochemical investigations and solve related analytical problems*	U, An, Ap,	PO2/PSO1, PSO2,PSO3

Mapping of CO with PO and PSO :

Course code SIUSBCH51; Course Title: Nutrition, Biomolecules & Biophysical Chemistry- I

Mapping Matrix	Academic competence	Critical Thinking & Anal skills	Research Aptitude	Eff. Comm. skills	Proficiency with ICT	Personal & Behavioral competence	Academic competence	Critical Thinking & Anal skills	Experiential learning & Lab. skills	Res. Aptitude & Interdisciplinary Approach
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	✓			✓			✓			
CO2	✓	✓					✓	✓		
CO3	✓						✓			
CO4	✓			✓			✓	✓		
CO5		✓					✓	✓	✓	

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Course Outcomes for TYBSc Biochemistry (3 Units)

Course code: SIUSBCH52 **Course Title:** Physiology, Metabolism & Applied Biochemistry- I

The study of this course will accomplish the following outcomes:

Unit	Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
Unit 1:	CO1 *Explain the biochemical steps of metabolism of carbohydrates and amino acids/proteins*	R, U	PO1, PO4/ PSO1
Unit 2:	CO1: *Explain the biochemical steps of metabolism of carbohydrates and amino acids/proteins* CO2: *Discuss the energy synthesis pathways in plants and animals*	R, U R, U	PO1, PO4/ PSO1 PO1, PO4/ PSO1
Unit 3:	CO3: *Describe the role of growth regulators/hormones in plants and animals and correlate it to physiological disorders*	R, U,	PO1, PO4/ PSO1
Unit 4	CO4 *Explain the processes of information transfer in prokaryotic cell and recognize these as target sites for drugs*	R, U, Ap, E	PO1, PO4/PSO1, PSO2

Mapping of CO with PO and PSO :

Course code SIUSBCH52; Course Title: Physiology, Metabolism & Applied Biochemistry- I

Mapping Matrix	Academic competence	Critical Thinking & Anal skills	Research Aptitude	Eff. Comm. skills	Proficiency with ICT	Personal & Behavioral competence	Academic competence	Critical Thinking & Anal skills	Experiential learning & Lab. skills	Res. Aptitude & Interdisciplinary Approach
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	✓			✓			✓			
CO2	✓			✓			✓			
CO3	✓			✓			✓			
CO4	✓	✓		✓			✓	✓		

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Course Outcomes for TYBSc Biochemistry (3 Units)

Course code: SIUSBCHP5 **Course Title:** Practical of course SIUSBCH51 & SIUSBCH52

The study of this course will accomplish the following outcomes:

Unit	Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
Unit 1:	CO 1. *Develop analytical skills and proficiency in preparation of standard solutions and buffers* 2. *Gain expertise in the isolation of biomolecules from their natural source.* 3. *Employ the basic reactions of biomolecules for their identification.* 4. *Develop competence in estimation of biomolecules by Spectroscopy* 5. *Acquire training to estimate activity of enzymes anddetermine the kinetic parameters, Km and Vmax* 6. *To employ basic statistics for analyzing and presenting experimental data*	R, U, An, Ap, E	PO1, PO2, PO6/ PSO1, PSO2, PSO3,

Mapping of CO with PO and PSO :

Course code SIUSBCHP5; Course Title: Practical of course SIUSBCH51 & SIUSBCH52

Mapping Matrix	Academic competence	Critical Thinking & Anal skills	Research Aptitude	Eff. Comm. skills	Proficiency with ICT	Personal & Behavioral competence	Academic competence	Critical Thinking & Anal skills	Experiential learning & Lab. skills	Res. Aptitude & Interdisciplinary Approach
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	✓	✓					✓	✓	✓	
CO2	✓					✓	✓		✓	
CO3	✓	✓				✓	✓	✓	✓	
CO4	✓						✓		✓	
CO5	✓					✓	✓		✓	
CO6	✓	✓					✓	✓	✓	

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Course Outcomes for TYBSc Biochemistry (3 Units)

Course code: SIUSBCH61 **Course Title:** Nutrition, Biomolecules & Biophysical Chemistry- II

The study of this course will accomplish the following outcomes:

Unit	Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
Unit 1: 1.1 1.2 1.4	CO1 *Express nutritional significance of vitamins and minerals and associated physiological disorders.* CO2 *Describe the structure and properties of lipids and correlate them with their biochemical functions* CO3: *Compute body mass indicators and deduce their significance.*	R, U U, An R, U, E	PO1, PO4/ PSO1 PO1,PO2, PO4/ PSO1, PSO2 PO1, PO2/ PSO1, PSO2
Unit 2:	CO4: *Discuss the composition of biological membranes, their function in transport and recognize the applications of artificial membrane vesicles*	R, U, E	PO1, PO2, PO4/ PSO1, PSO2
Unit 3:	CO5 *Recognize and express the role of biomolecules as pharmaceuticals* CO6 *Explain the steps in discovery and development of a drug/biopharmaceutical*	R, U, E R, U	PO1, PO2/ PSO1, PSO2 PO1, PSO1
Unit 4	CO7 *Employ techniques of centrifugation and electrophoresis in biochemical investigations and solve related analytical problems.*	U, An, Ap,	PO1, PO2/PSO1, PSO2, PSO3

Mapping of CO with PO and PSO :

Course code SIUSBCH61; Course Title: Nutrition, Biomolecules & Biophysical Chemistry- II

Mapping Matrix	Academic competence	Critical Thinking & Anal skills	Research Aptitude	Eff. Comm. skills	Proficiency with ICT	Personal & Behavioral competence	Academic competence	Critical Thinking & Anal skills	Experiential learning & Lab. skills	Res. Aptitude & Interdisciplinary Approach
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	✓			✓			✓			
CO2	✓	✓		✓			✓	✓		
CO3	✓	✓					✓	✓		
CO4	✓	✓		✓			✓	✓		
CO5	✓	✓					✓	✓		
CO6	✓						✓			
CO7	✓	✓					✓	✓	✓	

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Course Outcomes for TYBSc Biochemistry (3 Units)

Course code: SIUSBCH62 **Course Title:** Physiology, Metabolism & Applied Biochemistry- II

The study of this course will accomplish the following outcomes:

Unit	Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
Unit 1:	CO1 *Explain the biochemical steps of metabolism of lipids*	R, U	PO1, PO4/ PSO1
Unit 2:	CO2: *Discuss the basics of immunology and appreciate their application in diagnosis of diseases*	R, U, E	PO1, PO2, PO4/ PSO1, PSO2
Unit 3:	CO3: *Articulate steps in bioprocess technology and recognize its applications* CO4 *Describe the basic technique of tissue culture and identify its applications*	R, U, E R, U,	PO1, PO2, PO4/ PSO1, PSO2 PO1/ PSO1
Unit 4	CO5 *Explain the steps in recombinant DNA technology and recognize its applications* CO6 *Express the scope, applications and potentials of bioinformatics.*	R, U, Ap, E R, U, Ap	PO1, PO4/PSO1 PO1, PO4, PO5/ PSO1

Mapping of CO with PO and PSO :

Course code SIUSBCH62; Course Title: Physiology, Metabolism & Applied Biochemistry- II

Mapping Matrix	Academic competence	Critical Thinking & Anal skills	Research Aptitude	Eff. Comm. skills	Proficiency with ICT	Personal & Behavioral competence	Academic competence	Critical Thinking & Anal skills	Experiential learning & Lab. skills	Res. Aptitude & Interdisciplinary Approach
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	✓			✓			✓			
CO2	✓	✓		✓			✓	✓		
CO3	✓	✓		✓			✓	✓		
CO4	✓						✓			
CO5	✓	✓					✓	✓		
CO6	✓			✓	✓		✓			

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Course Outcomes for TYBSc Biochemistry (3 Units)

Course code: SIUSBCHP5 **Course Title:** Practical of course SIUSBCH51 & SIUSBCH52

The study of this course will accomplish the following outcomes:

Unit	Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
	1. *Gain expertise in the isolation of biomolecules from their natural source* 2. *Recognize plants as models for studying cytotoxicity of drugs* 3. *Employ the chemical properties of biomolecules for their estimation in food sample* 4. *Develop competence in separation and estimation of biomolecules* 5. *Acquire training in basic microbiology techniques* 6. *Employ basic statistics for analyzing experimental data.* 7. *Employ basic bioinformatics tools in the subject of biochemistry*	R, U, An, Ap, E	PO1, PO2, PO5, PO6/ PSO1, PSO2, PSO3,

Mapping of CO with PO and PSO :

Course code SIUSBCH62; Course Title: Physiology, Metabolism & Applied Biochemistry- II

Mapping Matrix	Academic competence	Critical Thinking & Anal skills	Research Aptitude	Eff. Comm. skills	Proficiency with ICT	Personal & Behavioral competence	Academic competence	Critical Thinking & Anal skills	Experiential learning & Lab. skills	Res. Aptitude & Interdisciplinary Approach
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	✓		-			✓	✓		✓	-
CO2	✓					✓	✓		✓	
CO3	✓	✓					✓	✓	✓	
CO4	✓	✓					✓	✓	✓	
CO5	✓					✓			✓	
CO6	✓	✓					✓	✓	✓	
CO7	✓				✓				✓	

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Program: BSc Botany

Class: FYBSc and SYBSc

Program Outcomes

Program Specific Outcomes

Course Outcomes

SIES College of Arts Science and Commerce, (Autonomous), Sion (West)

Department of Botany

POs, PSOs and COs for the three years Integrated B.Sc. Program

B.Sc. Botany
Program Outcomes and Program Specific Outcomes

Upon completion of this under-graduate degree program, a student will be able to accomplish the following program outcomes.

NO.	Details
PO1.	**Complex Problem Solving:** Applying the knowledge of various courses learned under a program with an ability to break down complex problems into simple components, by designing processes required for problem solving. *(Analyze, Apply, Evaluate)*
PO2.	**Critical Thinking:** Organizing thoughts to identify assumptions, verifying the accuracy and validity of assumptions, making informed decisions that guide actions (at Institutional, Personal and Intellectual level), developing the ability to think with different perspectives and ideas. *(Analyze, Apply, Evaluate, Create, Differentiate, Compare, Classify)*
PO3.	**Reasoning ability and Rational thinking:** Developing rational thinking on the basis of acquired contextual knowledge, assessing societal, public health and safety, cultural, legal, gender, ethnic and environmental issues, and performing with decisive responsibility. *(Analyze, Apply)*
PO4.	**Research Aptitude:** Utilizing the contextual knowledge in an interdisciplinary framework. Integrating research-based knowledge and research methods involving problem definition, analysis and interpretation of data, synthesis of the information to provide valid conclusions. *(Working on surveys, projects, assignments, solving new problems in practicals, analysing and interpreting practical, assignment or project results)*
PO5.	**Social Interactive Skills and team-work:** Eliciting networking with people, mediating disagreement and helping reach conclusions in group settings. Functioning effectively as an individual, and as a member in diverse groups, and in multidisciplinary settings exhibiting adaptability, leadership quality and team-building. *(Working together as team in practicals, working in groups for assignments, presentations and projects completions)*
PO6.	**Awareness towards Environment and Sustainable Development:** Exhibit awareness and a concern for environmental issues; understand and realize the significance of co-habitation and co-evolution in attaining the needs of sustainable development. *(Analyze, Apply, Evaluate, Create, Differentiate, Compare, Classify)*
PSO1.	**Sound Botanical knowledge gain and application:** Identify the different groups of plants and gain the knowledge about plant biodiversity and its conservation. Share social and environmental consciousness with the fellow citizens and motivate them towards taking fundamental steps towards environmental conservation. Utilize the botanical knowledge for problem solving and for taking real time decisions while working with plants in fields. Demonstrate comprehensive knowledge and understanding of the fundamental concepts of Botany and its applications to allied disciplines like Chemistry, Microbiology, Biotechnology, Lifesciences, Statistics and Bioinformatics. *(Remember, Understand, Explain, Compare, Classify, Analyse, Apply to solve interdisciplinary problems)*
PSO2.	**Acquiring proficiency in botanical techniques and methodologies:** Learn and apply different techniques, protocols and methodologies. Acquire knowledge of good laboratory practices and acquire research skills required for industrial support services. Inculcate scientific temperament, good reasoning power, technological and analytical skills while designing the experiments. *(Explain, Evaluate, Differentiate, Compare, Classify, learn the skills necessary for progression to higher education, research and in industry-based job prospects)*

(Dr. Mahavir Gosavi)
Head, Department of Botany

SIES College of Arts Science and Commerce, (Autonomous), Sion (West)

Department of Botany

POs, PSOs and COs for the three years Integrated B.Sc. Program

Programme Name: B.Sc. Botany Program Code: SIUSBOT
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
1	SIUSBOT11	2.0	3	Plant Diversity – I

CO. No.	Course Outcome of SIUSBOT11 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Identify and classify the diversity of bacteria, virus and algae.	R, U, Ap	PO3, PO5, PO6, PSO1, PSO2
CO2	Study the range of thallus in algae and acknowledge the economic importance of algae.	R, U, Ap	PO3, PO5, PO6, PSO1, PSO2
CO3	Identify and classify Phycomycetean fungi and also understand the different modes of nutrition in them with their applications in medicines and biotechnology.	R, U, Ap	PO3, PO5, PO6, PSO1, PSO2
CO4	Know the basic structure, classification, modes of nutrition in lichens along with their economic and ecological importance.	R, U, Ap	PO3, PO5, PO6, PSO1, PSO2
CO5	Learn and compare the lifecycles of *Riccia* and *Nephrolepis.*	R, U	PO3, PO5, PO6, PSO1, PSO2
CO6	Understand the stelar evolution in pteridophytes.	R, U	PO3, PO5, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Mapping of Plant Diversity – I Course COs with the POs and PSOs for B.Sc. (Botany) Programme

Mapping Matrix	Complex Problem Solving	Critical thinking	Reasoning ability and Rational thinking	Research Aptitude	Social Interactive Skills and team work	Awareness towards Environment and Sustainable Development	Sound Botanical knowledge gain and application	Acquiring proficiency in botanical techniques and methodologies
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	---	---	√	---	√	√	√	√
CO2	---	---	√	---	√	√	√	√
CO3	---	---	√	---	√	√	√	√
CO4	---	---	√	---	√	√	√	√
CO5	---	---	√	---	√	√	√	√
CO6	---	---	√	---	√	√	√	√

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POs, PSOs and COs for the three years Integrated B.Sc. Program

Programme Name: B.Sc. Botany Program Code: SIUSBOT
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
1	SIUSBOT12	2.0	3	Form and Function – I

CO. No.	Course Outcome of SIUSBOT12 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Know the basic components of cells w.r.t. their structure, and functions and enlist their importance.	R, U, Ap	PO2, PO3, PO5, PO6, PSO1, PSO2
CO2	Understand and differentiate the different stages of mitosis.	R, U, Ap, An	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO3	Acquire the knowledge of basic ecological concepts and learn the concept of bioremediation and analyse the role of different groups of organisms for the same	R, U, Ap, An	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO4	Study the concept of biodiversity and appreciate the biodiversity hotspots in India.	R, U, Ap, An	PO3, PO4, PO5, PO6, PSO1, PSO2
CO5	Understand the basics of inheritance and genetic variations and compare it with its modified ratios. Analyse the inheritance of multiple alleles.	R, U, Ap, An, E	PO1, PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO6	Learn the concepts in biometry and solve the problems based on measures of central tendency.	R, U, Ap, An, E	PO1, PO2, PO3, PO4, PO5, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Mapping of Form and Function – I Course COs with the POs and PSOs for B.Sc. (Botany) Programme

Mapping Matrix	Complex Problem Solving	Critical thinking	Reasoning ability and Rational thinking	Research Aptitude	Social Interactive Skills and team work	Awareness towards Environment and Sustainable Development	Sound Botanical knowledge gain and application	Acquiring proficiency in botanical techniques and methodologies
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	---	√	√	---	√	√	√	√
CO2	---	√	√	√	√	√	√	√
CO3	---	√	√	√	√	√	√	√
CO4	---	---	√	√	√	√	√	√
CO5	√	√	√	√	√	√	√	√
CO6	√	√	√	√	√	√	√	√

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POs, PSOs and COs for the three years Integrated B.Sc. Program

Programme Name: B.Sc. Botany Program Code: SIUSBOT
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
1	SIUSBOTP1.1	3.0	6	Plant Diversity I (Practical-I) & Form and Function I (Practical-II)

CO. No.	Course Outcome of SIUSBOTP1.1 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Observe the structure and diversity of bacteria, virus, algae, fungi, and lichens along with their economic importance.	R, U, Ap	PO2, PO4, PO5, PO6, PSO1, PSO2
CO2	Learn the structures in bryophytes, pteridophytes and lichens and acknowledge their economic and ecological significance.	R, U, Ap	PO2, PO4, PO5, PO6, PSO1, PSO2
CO3	Study the different stages of mitosis and identify the karyotypes and cell components.	R, U, Ap, An	PO2, PO4, PO5, PO6, PSO1, PSO2
CO4	Acquire the skills of data representation and solve the problems in biometry.	R, U, Ap, An, E, C	PO1, PO2, PO3, PO4, PO5, PSO1, PSO2
CO5	Appreciate the ecological adaptations in different groups of plants and biodiversity hotspots of India.	R, U, Ap, An	PO3, PO4, PO5, PO6, PSO1, PSO2
CO6	Know the inheritance patterns in genetics and work out the problems based on the same.	R, U, Ap, An, E	PO1, PO2, PO3, PO4, PO5, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Mapping of Practical – I (Plant Diversity - I) & Practical – II (Form and Function - I) Course COs with the POs and PSOs for B.Sc. (Botany) Programme

Mapping Matrix	Complex Problem Solving	Critical thinking	Reasoning ability and Rational thinking	Research Aptitude	Social Interactive Skills and team work	Awareness towards Environment and Sustainable Development	Sound Botanical knowledge gain and application	Acquiring proficiency in botanical techniques and methodologies
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	---	√	---	√	√	√	√	√
CO2	---	√	---	√	√	√	√	√
CO3	---	√	---	√	√	√	√	√
CO4	√	√	√	√	√	---	√	√
CO5	---	---	√	√	√	√	√	√
CO6	√	√	√	√	√	√	√	√

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POs, PSOs and COs for the three years Integrated B.Sc. Program

Programme Name: B.Sc. Botany Program Code: SIUSBOT
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
2	SIUSBOT21	2.0	3	Plant Diversity – I

CO. No.	Course Outcome of SIUSBOT21 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Study the structures and life cycles in *Cycas* along with economic and ecological significance of gymnosperms.	R, U, Ap	PO3, PO4, PO5, PO6, PSO1, PSO2
CO2	Understand geological time scale and analyse the evolutionary trends in plants.	R, U, Ap, An	PO2, PO3, PO4, PO6, PSO1, PSO2
CO3	Learn basic methods of angiosperm classification.	R, U	PO2, PO4, PO6, PSO1, PSO2
CO4	Acquire the knowledge of angiospermic families with economic importance.	R, U, Ap	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO5	Observe different morphological forms of leaves and inflorescence in plants.	R, U, Ap	PO3, PO4, PO5, PO6, PSO1, PSO2
CO6	Appreciate the various wonders of plant kingdom with their interesting and unique aspects.	R, U	PO3, PO5, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Mapping of Plant Diversity – I Course COs with the POs and PSOs for B.Sc. (Botany) Programme

Mapping Matrix	Complex Problem Solving	Critical thinking	Reasoning ability and Rational thinking	Research Aptitude	Social Interactive Skills and team work	Awareness towards Environment and Sustainable Development	Sound Botanical knowledge gain and application	Acquiring proficiency in botanical techniques and methodologies
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	---	---	√	√	√	√	√	√
CO2	---	√	√	√	---	√	√	√
CO3	---	√	---	√	---	√	√	√

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POs, PSOs and COs for the three years Integrated B.Sc. Program

CO4	---	√	√	√	√	√	√	√
CO5	---	---	√	√	√	√	√	√
CO6	---	---	√	---	√	√	√	√

Programme Name: B.Sc. Botany Program Code: SIUSBOT
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
2	SIUSBOT22	2.0	3	Form and Function – I

CO. No.	Course Outcome of SIUSBOT22 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Know the basic anatomy and tissue systems in higher plants.	R, U	PO3, PO4, PSO1, PSO2
CO2	Learn the different types of epidermal tissue systems and their significance.	R, U	PO3, PO4, PSO1, PSO2
CO3	Understand the role of photosynthetic pigments and light in the process of photosynthesis.	R, U, Ap, An	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO4	Acquire the knowledge of mechanism of photosynthesis and role of enzymes in plant metabolism.	R, U, Ap, An	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO5	Study the plants used in health care cosmetics.	R, U, Ap	PO3, PO4, PO5, PO6, PSO1, PSO2
CO6	Expand their knowledge w.r.t scope, career, and new trends in horticulture.	R, U, Ap	PO3, PO4, PO5, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Mapping of Form and Function – I Course COs with the POs and PSOs for B.Sc. (Botany) Programme

Mapping Matrix	Complex Problem Solving	Critical thinking	Reasoning ability and Rational thinking	Research Aptitude	Social Interactive Skills and team work	Awareness towards Environment and Sustainable Development	Sound Botanical knowledge gain and application	Acquiring proficiency in botanical techniques and methodologies
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**
CO1	---	---	√	√	---	---	√	√

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POs, PSOs and COs for the three years Integrated B.Sc. Program

CO2	---	---	√	√	---	---	√	√
CO3	---	√	√	√	√	√	√	√
CO4	---	√	√	√	√	√	√	√
CO5	---	---	√	√	√	√	√	√
CO6	---	---	√	√	√	√	√	√

Programme Name: B.Sc. Botany Program Code: SIUSBOT
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	**Course Code**	**Credits**	**Lectures/week**	**Course Name**
2	**SIUSBOTP2.1**	**3.0**	**6**	**Plant Diversity I (Practical-I) & Form and Function I (Practical-II)**

CO. No.	**Course Outcome of SIUSBOTP2.1 Upon completion of this course, student will be able to**	**Cognitive Level**	**Affinity with PO/ PSO**
CO1	Observe the structure of *Cycas* plant. Also learn the economic and ecological significance of gymnosperms.	R, U, Ap, An	PO2, PO3, PO5, PO6, PSO1, PSO2
CO2	Learn the variations in the morphology of leaves and inflorescence in angiosperms and appreciate different plant wonders.	R, U, Ap, An	PO2, PO3, PO5, PO6, PSO1, PSO2
CO3	Study the angiospermic families as per theory with their plants of economic importance in laboratory as well as field excursions.	R, U, Ap, An	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO4	Learn the techniques to observe and understand the primary anatomical structure of vegetative parts of dicots and monocots.	R, U, Ap, An	PO2, PO3, PO5, PO6, PSO1, PSO2
CO5	Identify important medicinal plants and acknowledge their uses in human health and cosmetics.	R, U, Ap, An	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO6	Perform the technique of paper chromatography, study of the enzyme activity and learn about upcoming gardening techniques.	R, U, Ap, An, E	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

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POs, PSOs and COs for the three years Integrated B.Sc. Program

Mapping of Practical – I (Plant Diversity - I) & Practical – II (Form and Function - I) Course COs with the POs and PSOs for B.Sc. (Botany) Programme

Mapping Matrix	Complex Problem Solving	Critical thinking	Reasoning ability and Rational thinking	Research Aptitude	Social Interactive Skills and team work	Awareness towards Environment and Sustainable Development	Sound Botanical knowledge gain and application	Acquiring proficiency in botanical techniques and methodologies
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	---	√	√	---	√	√	√	√
CO2	---	√	√	---	√	√	√	√
CO3	---	√	√	√	√	√	√	√
CO4	---	√	√	---	√	√	√	√
CO5	---	√	√	√	√	√	√	√
CO6	---	√	√	√	√	√	√	√

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POs, PSOs and COs for the three years Integrated B.Sc. Program

Programme Name: B.Sc. Botany Program Code: SIUSBOT
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
3	SIUSBOT31	2.0	3	Plant Diversity – II

CO. No.	Course Outcome of SIUSBOT31 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Identify, classify and understand the lifecycles of algae and bryophytes with their economic importance.	R, U, Ap	PO3, PO6, PSO1, PSO2
CO2	Learn and apply the knowledge of algal culturing and commercial importance of bryophytes in agriculture	R, U, Ap, An,	PO1, PO3, PO4, PSO1, PSO2
CO3	Identify and classify angiosperms based on Bentham & Hooker's system of classification.	R, U, Ap, An, E	PO1, PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO4	Know the floral morphology and economic importance of various angiosperms.	R, U, Ap, An	PO1, PO2, PO3, PSO1, PSO2
CO5	Understand and apply the principle of gel electrophoresis.	R, U, Ap, An	PO2, PO4, PO6, PSO1, PSO2
CO6	Know principle and techniques of microscopy and chromatography.	R, U, Ap, An, E	PO1, PO2, PO3, PO4, PO5, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Mapping of Plant Diversity – II Course COs with the POs and PSOs for B.Sc. (Botany) Programme

Mapping Matrix	Complex Problem Solving	Critical thinking	Reasoning ability and Rational thinking	Research Aptitude	Social Interactive Skills and team work	Awareness towards Environment and Sustainable Development	Sound Botanical knowledge gain and application	Acquiring proficiency in botanical techniques and methodologies
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	---	---	√	---	---	√	√	√
CO2	√	---	√	√	---	---	√	√
CO3	√	√	√	√	√	√	√	√
CO4	√	√	√	---	---	---	√	√
CO5	---	√	---	√	---	√	√	√
CO6	√	√	√	√	√	√	√	√

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POs, PSOs and COs for the three years Integrated B.Sc. Program

Programme Name: B.Sc. Botany Program Code: SIUSBOT
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
3	SIUSBOT32	2.0	3	Form and Function – II

CO. No.	Course Outcome of SIUSBOT32 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Know ultrastructure and functions of cell organelles, microbodies and interphase nucleus.	R, U, An, E	PO2, PO3, PO4, PO6, PSO1, PSO2
CO2	Understand the structure and function of nucleic acids. Compare the cell divisions with gaining the knowledge of cell cycle and its regulation.	R, U, Ap, An, E,	PO1, PO2, PO3, PO4, PO5, PSO1, PSO2
CO3	Evaluate the cytological and genetic effects chromosomal aberrations, and pattern of maternal inheritance.	R, U, Ap, An, E	PO1, PO2, PO3, PO4, PO5, PSO1, PSO2
CO4	Learn and analyse the concepts of sex determination, sex linked, and sex influenced- sex limited traits.	R, U, Ap, An, E	PO1, PO2, PO3, PO4, PO5, PSO1, PSO2
CO5	Understand and compare sedimentary biogeochemical cycles	R, U, Ap, An	PO1, PO3, PO4, PO5, PO6, PSO1, PSO2
CO6	Evaluate various ecological factors affecting soil characteristics and know the concepts of community ecology.	R, U, Ap, An, E	PO1, PO3, PO4, PO5, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Mapping of Form and Function – II Course COs with the POs and PSOs for B.Sc. (Botany) Programme

Mapping Matrix	Complex Problem Solving	Critical thinking	Reasoning ability and Rational thinking	Research Aptitude	Social Interactive Skills and team work	Awareness towards Environment and Sustainable Development	Sound Botanical knowledge gain and application	Acquiring proficiency in botanical techniques and methodologies
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	---	√	√	√	---	√	√	√
CO2	√	√	√	√	√	---	√	√
CO3	√	√	√	√	√	---	√	√

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POs, PSOs and COs for the three years Integrated B.Sc. Program

CO4	√	√	√	√	√	---	√	√
CO5	√	---	√	√	√	√	√	√
CO6	√	---	√	√	√	√	√	√

Programme Name: B.Sc. Botany Program Code: SIUSBOT
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
3	SIUSBOT33	2.0	3	Current Trends in Plant Sciences – I

CO. No.	Course Outcome of SIUSBOT33 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Know the concepts of Pharmacognosy, Pharmacopoeia and Monographs and evaluate the scope of Ayurveda system.	R, U, Ap	PO2, PO3, PO4, PO5, PSO1, PSO2
CO2	Learn the plants from Grandma's pouch and analyse the potential of secondary metabolites with its associated adulterations.	R, U, Ap, An, E	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO3	Understand and differentiate between basic and modern trends in forestry. Acquire and apply the knowledge of ecotourism.	R, U, Ap	PO4, PO5, PO6, PSO1, PSO2
CO4	Identify and appreciate the knowledge of commercially important plants	R, U, Ap	PO3, PO4, PO5, PO6, PSO1, PSO2
CO5	Acknowledge the potential of aromatherapy, botanicals and nutraceuticals.	R, U, Ap, An	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO6	Apply the knowledge of plant-based enzymes in industry and biofuels.	R, U, Ap, An, E	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Mapping of Form and Function – III Course COs with the POs and PSOs for B.Sc. (Botany) Programme

Mapping Matrix	Complex Problem Solving	Critical thinking	Reasoning ability and Rational thinking	Research Aptitude	Social Interactive Skills and team work	Awareness towards Environment and Sustainable Development	Sound Botanical knowledge gain and application	Acquiring proficiency in botanical techniques and methodologies
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2

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POs, PSOs and COs for the three years Integrated B.Sc. Program

CO1	---	√	√	√	√	---	√	√
CO2	---	√	√	√	√	√	√	√
CO3	---	---	---	√	√	√	√	√
CO4	---	---	√	√	√	√	√	√
CO5	---	√	√	√	√	√	√	√
CO6	---	√	√	√	√	√	√	√

Programme Name: B.Sc. Botany Program Code: SIUSBOT
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
3	**SIUSBOTP3.1**	**3.0**	**9**	**Practical I (Plant Diversity II), Practical II (Form and Function II) & Practical III (Current Trends in Plant Sciences I)**

CO. No.	Course Outcome of SIUSBOT41 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Identify, classify and observe the structural features in algae and bryophytes	R, U, Ap, An	PO3, PO5, PO6, PSO1, PSO2
CO2	Analyse different morphological variations in the floral structures and learn angiospermic families with economic importance.	R, U, Ap, An	PO2, PO3, PO5, PO6, PSO1, PSO2
CO3	Understand and apply modern techniques in plant diversity studies.	R, U, Ap, An, E	PO2, PO3, PO4, PO5, PSO1, PSO2
CO4	Observe and understand the ultrastructure of cell organelles, nucleic acids, inheritance pattern & chromosomal aberrations.	R, U, Ap, An	PO1, PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO5	Learn and apply the concepts of ecological experimentations.	R, U, Ap, An, E	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO6	Identify and acknowledge the significance of herbal drugs with their adulterants & economic importance.	R, U, Ap, An, E	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO7	Appreciate the plant wealth, plant diversity, forest types through field visits and ecotourism.	R, U, Ap, An, E	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

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POs, PSOs and COs for the three years Integrated B.Sc. Program

Mapping of Practical I (Plant Diversity II), Practical II (Form and Function II) & Practical III (Current Trends in Plant Sciences I) Course COs with the POs and PSOs for B.Sc. (Botany) Programme

Mapping Matrix	Complex Problem Solving	Critical thinking	Reasoning ability and Rational thinking	Research Aptitude	Social Interactive Skills and team work	Awareness towards Environment and Sustainable Development	Sound Botanical knowledge gain and application	Acquiring proficiency in botanical techniques and methodologies
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	--	--	√	--	√	√	√	√
CO2	--	√	√	--	√	√	√	√
CO3	--	√	√	√	√	--	√	√
CO4	√	√	√	√	√	√	√	√
CO5	--	√	√	√	√	√	√	√
CO6	--	√	√	√	√	√	√	√
CO7	--	√	√	√	√	√	√	√

Programme Name: B.Sc. Botany Program Code: SIUSBOT
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
4	SIUSBOT41	2.0	3	Plant Diversity – II

CO. No.	Course Outcome of SIUSBOT41 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Learn the general characters of fungi with the life cycles of *Aspergillus*, *Xylaria* and *Agaricus.*	R, U, Ap	PO3, PO4, PO5, PO6, PSO1, PSO2
CO2	Know the basic concepts of plant pathology & applications of fungi as bio-controlling agent.	R, U, Ap	PO3, PO4, PO5, PO6, PSO1, PSO2
CO3	Learn the salient features of Psilophyta and Lepidophyta among the pteridophytes along with the life cycle of *Selaginella.*	R, U, Ap	PO3, PO4, PO5, PO6, PSO1, PSO2

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POs, PSOs and COs for the three years Integrated B.Sc. Program

CO4	Understand the concept of Geological time scale and fossil formation process with prescribed form genera.	R, U, Ap	PO3, PO4, PO5, PO6, PSO1, PSO2
CO5	Expand their knowledge on gymnosperms with life cycles of *Pinus*.	R, U, Ap	PO3, PO4, PO5, PO6, PSO1, PSO2
CO6	Explore the economic importance of gymnosperms.	R, U, Ap	PO3, PO4, PO5, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Mapping of Plant Diversity – II Course COs with the POs and PSOs for B.Sc. (Botany) Programme

Mapping Matrix	**Complex Problem Solving**	**Critical thinking**	**Reasoning ability and Rational thinking**	**Research Aptitude**	**Social Interactive Skills and team work**	**Awareness towards Environment and Sustainable Development**	**Sound Botanical knowledge gain and application**	**Acquiring proficiency in botanical techniques and methodologies**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**
CO1	---	---	√	√	√	√	√	√
CO2	---	---	√	√	√	√	√	√
CO3	---	---	√	√	√	√	√	√
CO4	---	---	√	√	√	√	√	√
CO5	---	---	√	√	√	√	√	√
CO6	---	---	√	√	√	√	√	√

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POs, PSOs and COs for the three years Integrated B.Sc. Program

Programme Name: B.Sc. Botany Program Code: SIUSBOT
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
4	SIUSBOT42	2.0	3	Form and Function – II

CO. No.	Course Outcome of SIUSBOT42 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Understand the different types of mechanical and secretory tissues with vascular bundles in the plant.	R, U, Ap	PO3, PO4, PO5, PO6, PSO1, PSO2
CO2	Know the process of secondary growth and its different formations in plant organs.	R, U, Ap, An	PO3, PO4, PO5, PO6, PSO1, PSO2
CO3	Gain the knowledge of various processes related to respiration & photo respiration.	R, U, Ap, An	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO4	Analyse the effect of light on flowering in plants also understand the mechanism & applications of vernalization.	R, U, Ap, An	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO5	Learn the fundamentals of DNA replication and compare the same in prokaryotes and eukaryotes.	R, U, Ap, An	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO6	Explore the concept of central dogma emphasizing on transcription & mRNA processing.	R, U, Ap, An	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Mapping of Form and Function – II Course COs with the POs and PSOs for B.Sc. (Botany) Programme

Mapping Matrix	Complex Problem Solving	Critical thinking	Reasoning ability and Rational thinking	Research Aptitude	Social Interactive Skills and team work	Awareness towards Environment and Sustainable Development	Sound Botanical knowledge gain and application	Acquiring proficiency in botanical techniques and methodologies
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	---	---	√	√	√	√	√	√
CO2	---	---	√	√	√	√	√	√
CO3	---	√	√	√	√	√	√	√

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CO4	---	√	√	√	√	√	√	√
CO5	---	√	√	√	√	√	√	√
CO6	---	√	√	√	√	√	√	√

Programme Name: B.Sc. Botany Program Code: SIUSBOT
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
4	SIUSBOT43	2.0	3	Current Trends in Plant Sciences – I

CO. No.	Course Outcome of SIUSBOT43 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Explore the basic concepts in horticulture and its branches.	R, U, Ap	PO3, PO4, PO5, PO6, PSO1, PSO2
CO2	Learn the technique of indoor gardening and plants suitable for various garden locations with styles of flower arrangements.	R, U, Ap	PO3, PO4, PO5, PO6, PSO1, PSO2
CO3	Know the various sterilisation techniques and different in-vitro methods in plant tissue culture.	R, U, Ap, An	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO4	Expand the knowledge of gene cloning with respect to enzymes and vectors used.	R, U, Ap, An	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO5	Apply the concepts of Biostatistics for problem solving and comprehend the fundamental concepts related to descriptive and inferential biostatistics.	R, U, Ap, An, E	PO1, PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO6	Understand the concept of databases and its applications with the use of bioinformatics tools	R, U, Ap, An	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

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POs, PSOs and COs for the three years Integrated B.Sc. Program

Mapping of Form and Function – III Course COs with the POs and PSOs for B.Sc. (Botany) Programme

Mapping Matrix	Complex Problem Solving	Critical thinking	Reasoning ability and Rational thinking	Research Aptitude	Social Interactive Skills and team work	Awareness towards Environment and Sustainable Development	Sound Botanical knowledge gain and application	Acquiring proficiency in botanical techniques and methodologies
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	---	---	√	√	√	√	√	√
CO2	---	---	√	√	√	√	√	√
CO3	---	√	√	√	√	√	√	√
CO4	---	√	√	√	√	√	√	√
CO5	√	√	√	√	√	√	√	√
CO6	---	√	√	√	√	√	√	√

Programme Name: B.Sc. Botany Program Code: SIUSBOT
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
4	SIUSBOTP4.1	3.0	9	Practical I (Plant Diversity II), Practical II (Form and Function II) & Practical III (Current Trends in Plant Sciences I)

CO. No.	Course Outcome of SIUSBOTP4.1 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Observe the structures in fungi, pteridophytes and gymnosperms as per theory.	R, U, Ap	PO3, PO4, PO5, PO6, PSO1, PSO2
CO2	Acquire the knowledge of plant fossils & fungal diseases.	R, U, Ap, An	PO3, PO4, PO5, PO6, PSO1, PSO2
CO3	Identify different types of mechanical and secretory tissues in plants. Learn secondary growth by sectioning technique.	R, U, Ap, An	PO3, PO4, PO5, PO6, PSO1, PSO2

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CO4	Perform the plant physiology experiments to enhance the concepts.	R, U, Ap, An, E	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO5	Apply the knowledge of sequencing for DNA and Amino acids.	R, U, Ap, An, E	PO1, PO2, PO3, PO4, PO5, PSO1, PSO2
CO6	Create different styles of flower arrangements and indoor gardens.	R, U, Ap, An, C	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO7	Solve the problems of biostatistics & explore the different bioinformatics tools.	R, U, Ap, An, E	PO1, PO2, PO3, PO4, PO5, PO6, PSO1, PSO2
CO8	Appreciate the plant wealth, plant diversity, garden styles through field visits and exhibitions.	R, U, Ap, An	PO2, PO3, PO4, PO5, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Mapping of Practical I (Plant Diversity II), Practical II (Form and Function II) & Practical III (Current Trends in Plant Sciences I) Course COs with the POs and PSOs for B.Sc. (Botany) Programme

Mapping Matrix	Complex Problem Solving	Critical thinking	Reasoning ability and Rational thinking	Research Aptitude	Social Interactive Skills and team work	Awareness towards Environment and Sustainable Development	Sound Botanical knowledge gain and application	Acquiring proficiency in botanical techniques and methodologies
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	--	--	√	√	√	√	√	√
CO2	--	--	√	√	√	√	√	√
CO3	--	--	√	√	√	√	√	√
CO4	--	√	√	√	√	√	√	√
CO5	√	√	√	√	√	--	√	√
CO6	--	√	√	√	√	√	√	√
CO7	√	√	√	√	√	√	√	√
CO8	--	√	√	√	√	√	√	√

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Program: BSc Chemistry

Class: FYBSc and SYBSc

Program Outcomes

Program Specific Outcomes

Course Outcomes

B.Sc. Chemistry

Final Programme Outcomes and Program Specific Outcomes

A student completing B.Sc. Chemistry will be able to:

PSO 1: Acquire sound foundation in the basics of chemistry, ability to comprehend the essential facts, principles, theories in physical chemistry, organic chemistry, inorganic chemistry and analytical chemistry.

PSO 2: Application of knowledge learnt to understand, interpret derivations and solve numerical problems.

PSO 3: Acquire working knowledge of different instruments used in qualitative and quantitative chemical analysis as well as the required skills for operation of different instruments.

PSO 4: Ability to analyze the environmental aspect of the chemicals.

PSO 5: Acquire atomic and molecular orbital approach to study the applications in the chemistry of inorganic compounds.

POS 6: To outline the nature and basic concepts of bond formation, stereochemistry and reaction mechanism in organic chemistry

POS 7: Acquire practical knowledge of different qualitative and quantitative chemical analysis

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Course Outcomes
SEM – I, Paper – I COs

	Course Outcome	PSO	C L	K C
CO 1	Explain the thermodynamics terms like system, surroundings, boundaries, distinguish between open, closed and isolated system, differentiate between intensive and extensive properties, distinguish between state function and path function.	PSO1, PSO2	Ap	C, F
CO 2	Interpret the laws of thermodynamics, obtain the relation between thermodynamic parameters, free energy, establish relation between ΔG and spontaneity.	PSO1, PSO2	Ap	C, F
CO 3	To calculate heat of reactions, apply Hess's law of constant heat summation for solving numerical problems, calculation of bond energy, bond dissociation energy and resonance energy.	PSO1, PSO2	Ap	C
CO 4	Express concentration terms like normality, molality, molarity, formality, mole fraction, ppm, ppb as well as their interconversion	PSO1, PSO2	Ap	C
CO 5	Introduce structure of atoms and describe the role of quantum numbers and shape of orbitals	PSO1	U	C
CO 6	Outline the periodicity of elements and interpret the trends in variation of periodic properties.	PSO1	An	C, P
CO 7	Inspect the basics of chemical bonding and their types, emphasizing on energy changes involved in ionic bond.	PSO1, PSO2	Ap	C, P
CO 8	Convert the names of organic compounds into their structures and vice- a-versa.	PSO 6	An	C, F
CO 9	Explain the appropriate geometry of organic molecules through the concept of hybridization.	PSO 6	An	C,F
CO 10	Identify the stability of organic species with the help of various electronic effects and their applications in studying organic reaction mechanism.	PSO 6	An	C,F

SEM-I, Paper-II COs

	Course Outcome	PSO	C L	K C
CO 1	Define rate of reaction, rate constant, distinguish between order and molecularity, derive the integrated rate equation of first order, second order (with equal initial concentration of reactant as well as unequal initial concentration of reactant), determine the order of reaction by a) integration method b) graphical method c) Ostwald's method d) halftime method and solve numerical of above topics.	PSO1, PSO2	Ap	C, F
CO 2	Discuss the terms surface tension, viscosity and refractive index and their determination, solving numerical based on above topics.	PSO1, PSO2	Ap	C, P
CO 3	Illustrate the term liquid crystals, classification and applications.	PSO1, PSO2	Ap	C
CO 4	Analyze the trends of properties of the 's' and 'p' block elements.	PSO1	An	C, P
CO 5	Ability to understand the importance of protection and conservation of our environment and Create awareness about the human activities which leads to the indiscriminate release of air pollutants into the environment.	PSO1, PSO4	Ap	C, P
CO 6	Apply different methods to balance redox equations.	PSO1, PSO2	Ap	C, P
CO 7	Draw the configuration of organic molecules in various projection formulas and interconvert them.	PSO 6	Ap	C, F
CO 8	Recognize and explain structural isomers and stereoisomers	PSO 6	Ap	C, F
CO 9	Identify the stereocenters in a molecule and assign the configuration for simple chiral molecules.	PSO 6	Ap	C, F

SEM-I, Practical in Chemistry COs

	Course Outcome	PSO	C L	K C
CO 1	Explain experiments that has specific aims with correct techniques.	PSO7	Ap	C
CO 2	Apply skills of observation, recording and analyzing data	PSO7	Ap	C, F
CO 3	Utilize various separation techniques and identify chemical species	PSO7	Ap	C, P
CO 4	Discuss historical methods of chemical analysis and apply in a systematic manner	PSO7	Ap	C, P

SEM-II, Paper-I COs

	Course Outcome	PSO	C L	K C
CO 1	Describe the gas laws, kinetic theory of gases, interpret Maxwell-Boltzmann distribution of velocities, knowledge about real gases, ideal gases and compressibility factor and solve numericals.	PSO1, PSO2	Ap	C, F
CO 2	Interpret deviation from ideal gas laws, discuss vander Waal's equation of state, Joule Thomson effect, inversion temperature and should be able to apply the knowledge to solve numerical problems.	PSO1, PSO2	Ap	C, F
CO 3	Differentiate between reversible and irreversible reaction, interpret law of mass action, derive the expression for Kp and Kc and their relationship, solve numericals based on the above concept. Interpretation of Le Chatlier's principle and factors affecting chemical equilibrium.	PSO1, PSO2	Ap	C
CO 4	Create an awareness about curtailing the wastage of chemical reagents with the knowledge of various techniques involved during qualitative analysis with reference to the role of impregnated test papers.	PSO1, PSO4	U	C
CO 5	Examine the various acid base theories and their applications	PSO1	U	C
CO 6	Describe the functional group transformation for formation of organic compounds.	PSO 6	Ap	C, F
CO 7	Plan simple synthesis of organic compounds.	PSO 6	Ap	C, F
CO 8	Write the reactions with appropriate mechanism of aliphatic hydrocarbons.	PSO 6	Ap	C, F

SEM-II, Paper-II, COs

	Course Outcome	PSO	C L	K C
CO 1	Describe the concept of ionic equilibria w.r.t acids, bases, common ion effect.	PSO1, PSO2	Ap	C
CO 2	Explain the types of buffer system and solve numerical by using Henderson's equation.	PSO1, PSO2	Ap	C
CO 3	Describe and illustrate the interaction of radiation with matter leading to different types of spectroscopy.	PSO1, PSO2	Ap	C
CO 4	Discuss about types of crystals, laws of crystallography and calculations of Miller indices.	PSO1, PSO2	Ap	C
CO 5	To apply various theories to identify the shapes of covalent molecules.	PSO1, PSO2, PSO5	Ap	C, P
CO 6	Interpret the applications of redox chemistry and examine redox stability in water.	PSO1, PSO2	U	C, P
CO 7	Draw various conformations of alkanes/cycloalkanes and predict their relative stabilities.	PSO 6	Ap	C, F
CO 8	Identify aromaticity, anti-aromatic and non-aromatic compounds based on their structures	PSO 6	Ap	C, F
CO 9	Write the reactions and outline the mechanism of electrophilic aromatic substitution reactions.	PSO 6	Ap	C, F
CO 10	Predict the reactivity and orientation effects of substituents on electrophilic aromatic substitution in substituted benzene.	PSO 6	Ap	C, F

SEM-II, Practical in Chemistry COs

	Course Outcome	PSO	C L	K C
CO 1	Explain experiments that has specific aims with correct techniques.	PSO7	Ap	C
CO 2	Apply skills of observation, recording and analyzing data	PSO7	Ap	C, F
CO 3	Utilize various separation techniques and identify chemical species	PSO7	Ap	C, P
CO 4	Discuss historical methods of chemical analysis and apply in a systematic manner	PSO7	Ap	C, P

Program: BSc Mathematics

Class: FYBSc and SYBSc

Program Outcomes

Program Specific Outcomes

Course Outcomes

Program Name: B.Sc. Mathematics

(3-year Integrated Degree Program)

Program Outcomes and Program Specific Outcomes

B.Sc. Mathematics

Upon completion of this undergraduate degree program, a student will be able to accomplish the following program outcomes.

SR. NO.	Details
PO1.	**Solving Complex Problems:** Applying the knowledge of various courses learned under a program with an ability to break down complex problems into simple components, by designing processes required for problem solving. *Cognitive Levels: An, Ap*
PO2.	**Critical Thinking and reasoning ability:** Exhibits ability to understand abstract concepts, analyse, and apply them in problem solving. Ability to formulate and develop logical arguments. Developing the ability to think with different perspectives and ideas. (Skills necessary for progression to higher education and research.) *Cognitive Levels: U, An*
PO3.	**Research Aptitude:** Acquiring the ability to explore and gain knowledge in independent ways through reading assignments, problem solving assignments, projects, seminars, presentations. *Cognitive Levels: Ap, An, E, C*
PO4.	**Proficiency with ICT**: Equip to select, apply appropriate tools and techniques, resources through electronic media for the purpose of visualizing mathematical objects, geometrical interpretations, coding, and analysing data. *Cognitive Levels: U, Ap*
PSO1.	**Sound Disciplinary knowledge:** Demonstrate comprehensive knowledge and understanding of the fundamental concepts and theories of mathematics. *Cognitive Levels: R, U*
PSO2.	**Communicating Mathematical Ideas:** Organize and deliver mathematical ideas through effective written, verbal, graphical/virtual communications. *Cognitive Levels: R, U*

Course Outcomes: F.Y.B.Sc.

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Semester 1

Course Code	Credits	Lectures/week	Course Name
SIUSMAT11	2	3	Calculus1

Unit1: Real numbers System
Unit2: Limit and Continuity of real valued functions
Unit3: First order First degree Differential equations

CO. No.	Course Outcome of SIUSMAT11 Upon completion of this course, students will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	State definitions of Supremum, Infimum, bounded sets, properties and inequalities of real numbers, limit, continuity, order and degree of an ode and its various types, and prove important results and inequalities of real numbers, continuity and ODEs	R, U	PSO1, PSO2
CO2	Apply various properties, results and inequalities to solve problems on intervals, neighborhoods, boundedness and to solve ODEs	Ap, An	PO1, PO2, PSO2
CO3	Determine continuity at a point or on intervals and distinguish between the types of discontinuities at a point, Identify bounded and unbounded sets, Identify the type of DEs and solve it using appropriate methods.	Ap, An	PO1, PO2, PO3

Course Code	Credits	Lectures/week	Course Name
SIUSMAT12	2	3	Algebra I

CO. No.	Course Outcome of SIUSMAT12 Upon completion of this course, students will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	State definitions and prove results based on divisibility of integers, GCD, prime, congruence, function and its different types, binary operation, relation and its different types, partitions and equivalence relations, roots and irreducibility of polynomials. State the well ordering property, induction theorems, fundamental theorem of Arithmetic, theorems associated to roots of various polynomials	R, U	PSO1, PSO2
CO2	Apply various results to find GCD, prove propositions based on induction theorems, solve problems based on congruences, check bijectivity of functions, find roots of a polynomial, GCD of polynomials	Ap, An	PO1, PO2, PSO2
CO3	Identify invertible functions, binary operations, partitions and equivalence relations, irreducible polynomials, factors of a polynomial, multiplicity of a root.	Ap, An	PO1, PO2, PO3

Course Code	Credits	Lectures/week	Course Name
SIUSMATP1	2	2	Practicals in both the theory Courses

CO. No.	Course Outcome of SIUSMATP1 Upon completion of this course, students will be able to	Cognitive Level	Affinity with PO/ PSO

CO1	Apply various definitions, results and methods learnt in three theory courses to plot graphs and solve problems.	Ap	PO1, PO2
CO2	Explore mathematical softwares/mobile apps like Matlab/ Scilab/ Geogebra/ SAGE/ Desmos to solve problems and visualize solids. (free and open versions)	Ap	PO4
CO3	Test validity of mathematical statements using results and constructing appropriate examples	E, Cr	PO3

Semester 2

	Course Code	Credits	Lectures/week	Course Name
	SIUSMAT21	**2**	**3**	**Calculus2**

CO. No.	Course Outcome of SIUSMAT21 Upon completion of this course, students will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	State the definitions of convergent, divergent, oscillating , bounded and monotone sequences, derivatives and related terms. State and prove results on convergence and boundedness of sequences, differentiability, Mean Value theorems and extreme values of a function	R, U	PSO1, PSO2
CO2	Plot graphs of standard functions and comment on continuity; Apply various results to check boundedness, convergence of sequences, Apply the notions of continuity and differentiability to algebraic and transcendental functions to solve problems and to compute higher order derivatives.	Ap, An	PO1, PO2, PSO2
CO3	Identify critical points and classify into maxima, minima saddle points, classify sequences and other real valued functions based upon their properties	Ap, An	PO1, PO2, PO3

Course Code	Credits	Lectures/week	Course Name
SIUSMAT22	**2**	**3**	**Algebra II**

CO. No.	Course Outcome of SIUSMAT22 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	State definitions of countable set, Stirling number of second kind, derangements, permutations, recurrence relations State Pigeonhole principle, multinomial theorem, inclusion and exclusion principle, State and prove results based on countability of sets, permutations, combinations, Stirling numbers, identities based on multinomial theorem.	R, U	PSO1, PSO2
CO2	Solve problems based on counting principles, pigeonhole principles, multinomial theorem, Inclusion & Exclusion principle, derangements, recurrence relations	Ap, An	PO1, PO2, PSO2
CO3	Classify sets based on countability, identify recurrence relations as homogeneous/non-homogeneous, types of permutations	Ap, An	PO1, PO2, PO3

Course Code	Credits	Lectures/week	Course Name
SIUSMATP2	**2**	**2**	**Practicals in both the theory Courses**

CO. No.	Course Outcome of SIUSMATP2 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO

CO1	Apply various definitions, results and methods learnt in three theory courses to plot graphs and solve problems.	Ap	PO1, PO2
CO2	Explore mathematical softwares/mobile apps like Matlab/ Scilab/ Geogebra/ SAGE/ Desmos to solve problems and visualize solids. (free and open versions)	Ap	PO4
CO3	Test validity of mathematical statements using results and constructing appropriate examples	E, Cr	PO3

Course Outcomes: S.Y.B.Sc.

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Semester 3

Course Code	Credits	Lectures/week	Course Name
SIUSMAT31	2	3	Integral Calculus of one Variables

Unit1. Infinite Series
Unit2. Riemann Integration and applications
Unit3. Indefinite and improper integrals

CO. No.	Course Outcome of SIUSMAT31 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	State the definitions and prove results based on concepts summation and convergence of a series, the lower and upper Riemann integrals, the beta, gamma functions, indefinite and improper integrals.	R,U	PSO1, PSO2
CO2	Apply various definitions and results learnt to solve problems on convergence of infinite series, improper integrals, upper and lower sums and checking integrability, problems in physics	Ap	PO1, PO2
CO3	Test the validity of mathematical statements and converses based upon the gained knowledge, choose appropriate methods to discuss integrability of a function, convergence of an integral and that of a series.	Ap, An, E	PO1, PO2

Course Code	Credits	Lectures/week	Course Name
SIUSMAT32	2	3	Linear Algebra

Unit1. System of Equations and Matrices
Unit2. Vector Spaces over IR
Unit3. Determinants, Linear Equations (Revisited)

CO. No.	Course Outcome of SIUSMAT32 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	State the definitions and prove the results of Systems of homogeneous and non-homogeneous linear equations, row echelon form of matrices, elementary matrices, Vector space over R, its basis, determinant.	R, U	PSO1, PSO2
CO2	Solve problems in system of linear equations using Gaussian elimination, Cramer's rule, *LU* Decomposition, finding inverse of matrix, checking Linear independence of subsets of a vector space	Ap, An	PO1, PO2

Course Code	Credits	Lectures/week	Course Name
SIUSMAT33	2	3	Discrete Mathematics

Unit1. Solutions of algebraic and transcendental equations
Unit2. Interpolation, Curve fitting, Numerical integration
Unit3. Solutions of linear system of Equations and Numerical Differentiation

CO. No.	Course Outcome of SIUSMAT33 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	State definitions of concepts such as relative, absolute and percentage errors, accuracy, precision and explain Interpolation using different types of operators-Forward, backward and shift. State and derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.	R, U	PSO1, PSO2
CO2	Apply numerical techniques to find the roots of nonlinear equations, solution of systems of linear equations, numerical integration and differentiation	Ap, An	PO1, PO2
CO3	Evaluate limitations, advantages, disadvantages and accuracy of different numerical methods	An, E	PO1, PO2, PO3

Course Code	Credits	Lectures/week	Course Name
SIUSMATP3	3	6	Practicals based on all the three theory courses

CO. No.	Course Outcome of SIUSMATP3 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Apply various definitions, results and methods learnt in three theory courses to plot graphs and solve problems.	Ap	PO1, PO2
CO2	Explore mathematical softwares/mobile apps like Matlab/ Scilab/ Geogebra/ SAGE/ Desmos to solve problems and visualize solids. (free and open versions)	Ap	PO4
CO3	Test validity of mathematical statements using results and constructing appropriate examples	E, Cr	PO3

Course Code	Credits	Lectures/week	Course Name
SIUSMAT41	2	3	Multivariable Differential Calculus

Unit1. Functions of several variables
Unit2. Differentiation of Scalar Fields
Unit3. Applications of Differentiation of Scalar Fields and Differentiation of Vector Fields

CO. No.	Course Outcome of SIUSMAT41 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
1	State the definitions and prove results based on concepts continuity, partial and directional derivatives, the gradient vector, total derivative of scalar and vector fields.	R,U	PSO1, PSO2
2	Apply various definitions learnt to identify and plot quadric surfaces and level curves, compute gradient, partial and directional derivatives, Jacobian and total derivatives, extreme values.	Ap	PO1, PO2

3	Test the validity of mathematical statements and converses based upon the gained knowledge, to discuss the differentiability of a function, existence of derivatives.			Ap, An, E	PO1, PO2
	Course Code	**Credits**	**Lectures/week**	**Course Name**	
	SIUSMAT42	**2**	**3**	**Linear Algebra II**	
	Unit1. Linear transformation, Isomorphism, Matrix associated with L.T. **Unit2. Inner product spaces** **Unit3. Eigenvalues, Eigen vectors, diagonalizable matrix**				
CO. No.	**Course Outcome of SIUSMAT42 Upon completion of this course, student will be able to**			**Cognitive Level**	**Affinity with PO/ PSO**
1	State the definitions and prove the results in kernel and image of linear transformations, matrix associated with linear transformation, Inner Products and Orthogonality, Eigenvalues, Eigenvectors and Diagonalization.			R, U	PSO1, PSO2
2	Solve problems of finding kernel and image of linear transformation, finding matrix associated with linear transformation, finding orthonormal set using			Ap, An	PO1, PO2
3	Gram-Schmidt orthogonalization, finding eigenvalues, eigenvectors and Diagonalizing a matrix. Gram-Schmidt orthogonalization, finding eigenvalues, eigenvectors and Diagonalizing a matrix.			Ap, An	PO1, PO2
	Course Code	**Credits**	**Lectures/week**	**Course Name**	
	SIUSMAT43	**2**	**3**	**Ordinary Differential Equations**	
CO. No.	**Course Outcome of SIUSMAT43 Upon completion of this course, student will be able to**			**Cognitive Level**	**Affinity with PO/ PSO**
1	To have a working knowledge of basic application problems described by second order linear differential equations with constant coefficients.			R, U	PSO1, PSO2
2	To find the complete solution of a nonhomogeneous differential equation as a linear combination of the complementary function and a particular solution, by the method of undetermined coefficients and variation of parameters.			Ap, An	PO1, PO2
3	Create and analyze mathematical models using higher order differential equations to solve application problems.			Ap, An,Cr	PO1, PO2, PO3
	Course Code	**Credits**	**Lectures/week**	**Course Name**	
	SIUSMATP4	**3**	**6**	**Practicals based on Courses**	
CO. No.	**Course Outcome of SIUSMATP4 Upon completion of this course, student will be able to**			**Cognitive Level**	**Affinity with PO/ PSO**
1	Apply various definitions, results and methods learnt in three theory courses to plot graphs and solve problems.			Ap	PO1, PO2
2	Explore mathematical softwares like Matlab/ Scilab/ Geogebra/ SAGE/ Desmos to solve problems and visualize solids.			Ap	PO1, PO2
3	Test validity of mathematical statements using results and constructing appropriate examples.			E, Cr	PO3

Program: BSc Microbiology

Class: FYBSc and SYBSc

Program Outcomes

Program Specific Outcomes

Course Outcomes

SIES College of Arts Science and Commerce, (Autonomous), Sion (West)

Department of Microbiology

POs, PSOs and COs for the three years Integrated B.Sc. Program

B.Sc. Microbiology
Program Outcomes and Program Specific Outcomes

Upon completion of this under-graduate degree program, a student will be able to accomplish the following program outcomes.

NO.	Details
PO1.	**Complex Problem Solving:** Applying the knowledge of various courses learned under a program with an ability to break down complex problems into simple components, by designing processes required for problem solving. *(Analyze, Apply, Evaluate)*
PO2.	**Critical Thinking:** Organizing thoughts to identify assumptions, verifying the accuracy and validity of assumptions, making informed decisions that guide actions (at Institutional, Personal and Intellectual level), developing the ability to think with different perspectives and ideas. *(Analyze, Apply, Evaluate, Create, Differentiate, Compare, Classify)*
PO3.	**Reasoning ability and Rational thinking:** Developing rational thinking on the basis of acquired contextual knowledge, assessing societal, public health and safety, cultural, legal, gender, ethnic and environmental issues, and performing with decisive responsibility. *(Analyze, Apply)*
PO4.	**Research Aptitude:** Utilizing the contextual knowledge in an interdisciplinary framework. Integrating research-based knowledge and research methods involving problem definition, analysis and interpretation of data, synthesis of the information to provide valid conclusions. *(Working on surveys, projects, assignments, solving new problems in practicals, analysing and interpreting practical, assignment or project results)*
PO5.	**Social Interactive Skills and team-work:** Eliciting networking with people, mediating disagreement and helping reach conclusions in group settings. Functioning effectively as an individual, and as a member in diverse groups, and in multidisciplinary settings exhibiting adaptability, leadership quality and team-building. *(Working together as team in practicals, working in groups for assignments, presentations and projects completions)*
PO6.	**Awareness towards Environment and Sustainable Development:** Exhibit awareness and a concern for environmental issues; understand and realize the significance of co-habitation and co-evolution in attaining the needs of sustainable development. *(Analyze, Apply, Evaluate, Create, Differentiate, Compare, Classify)*
PSO1.	**Sound Microbiology knowledge gain and application:** Identify the different groups of microbes and gain the knowledge about Microbial biodiversity. Share social and environmental consciousness with the fellow citizens and motivate them towards taking fundamental steps towards environmental conservation. Utilize the microbiological knowledge for problem solving and for taking real time decisions while working with microbes in fields. Demonstrate comprehensive knowledge and understanding of the fundamental concepts of Microbiology and its applications to allied disciplines like Chemistry, Botany, Biotechnology, Lifesciences, Statistics and Bioinformatics. *(Remember, Understand, Explain, Compare, Classify, Analyse, Apply to solve interdisciplinary problems)*
PSO2.	**Acquiring proficiency in Microbial techniques and methodologies:** Learn and apply different techniques, protocols and methodologies. Acquire knowledge of good laboratory practices and acquire research skills required for industrial support services. Inculcate scientific temperament, good reasoning power, technological and analytical skills while designing the experiments. *(Explain, Evaluate, Differentiate, Compare, Classify, learn the skills necessary for progression to higher education, research and in industry-based job prospects)*

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Department of Microbiology

POs, PSOs and COs for the three years Integrated B.Sc. Program

Programme Name: B.Sc. Microbiology Program Code: SIUSMIC
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
1	SIUSMIC11	2.0	3	Fundamentals of Microbiology

CO. No.	Course Outcome of SIUSMIC11 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Describe Scope and history of Microbiology.	R, U,	PO3, PO6, PSO1,PSO2
CO2	Understand prokaryotic cell structure	R, U,	PO3, PO6, PSO1,PSO2
CO3	To understand the structure of nucleic acid and their relation to the genetic material.	R, U, Ap, An	PO3, PO6, PSO1,PSO2
CO4	Applications of biotechnology	R, U, Ap, C	PO3, PO6, PSO1,PSO2
CO5	Differentiate between various nutritional types of bacteria and deduce methods for their cultivation	R, U, An, E	PO3, PO6, PSO1,PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Programme Name: B.Sc. Microbiology Program Code: SIUSMIC
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
1	SIUSMIC12	2.0	3	Basics of Microbiology I

CO. No.	Course Outcome of SIUSMIC12 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Describe the functioning of the light microscope.	R, U	PO2, PO3, PO6,PSO1
CO2	Visualization strategy of microorganisms using staining techniques.	R, U, Ap, An	PO2, PO3, PO4, PO6, PSO1
CO3	Understand Eukaryotic cell structure	R, U	PO2, PO3, PO4, PO5, PO6, PSO1
CO4	Describe the significance of sterilization procedure and application of physical and chemical methods for control of microbes.	R, U, Ap, E, C	PO3, PO4, PO5, PO6, PSO1

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

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POs, PSOs and COs for the three years Integrated B.Sc. Program

Programme Name: B.Sc. Microbiology Program Code: SIUSMIC
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
1	SIUSMICP1	3.0	6	Practical-I & II

CO. No.	Course Outcome of SIUSMICP1 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Know the working of a microscope	R, U	PO2, PO4, PO5, PO6, PSO1, PSO2
CO2	Observe the structure, morphology and various cytoplasmic inclusion bodies of different bacteria	R, U, An	PO2, PO4, PO5, PO6, PSO1, PSO2
CO3	Learn the different sterilization methods and evaluate their efficiency	R, U, An, E	PO2, PO4, PO5, PO6, PSO1, PSO2
CO4	Acquire the skills for microbiological media preparation	R, U, Ap	PO1, PO2, PO4,PO5, PSO1, PSO2
CO5	Learning and practicing professional skills in handling microbes	R, U, Ap, An, E	PO1, PO2, PO3, PO4,PO5, PSO1, PSO2
CO6	Learn qualitative methods to identify biomolecules	R, U, Ap, An	PO1, PO2, PO4, PO5, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Programme Name: B.Sc. Microbiology Program Code: SIUSMIC
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
2	SIUSMIC21	2.0	3	Basics of Microbiology II

CO. No.	Course Outcome of SIUSMIC21 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Understand characteristics of diverse groups such as Viruses, Archaebacteria and Actinomycetes etc with respect to medical & ecological importance.	R, U, Ap	PO1, PO6, PSO1, PSO2
CO2	Understand and classify major groups of eukaryotes (Algae, Fungi, and Protozoa) and their biological, economical and medical significance.	R, U, Ap	PO1, PO2, PO3, PO6, PSO1, PSO2
CO3	To understand the knowledge of microbial interaction and evaluate its beneficial and detrimental effects including biofilms	R, U, An, Ap, C, E	PO1, PO2, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

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POs, PSOs and COs for the three years Integrated B.Sc. Program

Programme Name: B.Sc. Microbiology Program Code: SIUSMIC
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
2	SIUSMIC22	2.0	3	Exploring Microbiology

CO. No.	Course Outcome of SIUSMIC22 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	To understand microbial growth and study the parameters evaluating growth.	R, U, An	PO2, PSO1,
CO2	Describe and evaluate the different biomolecules that make up the microbial cell and understand their role in cellular metabolism	R, U, An	PO2, PSO1,
CO3	Analyze the role of the host immune system in response to the microbial virulence factors.	R, U, An, E	PO2, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Programme Name: B.Sc. Microbiology Program Code: SIUSMIC
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
2	SIUSMICP2	3.0	6	(Practical-I) & (Practical-II)

CO. No.	Course Outcome of SIUSMICP2 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Identify bacteriophages from a sample	R, U, Ap, An, E	PO2, PO4, PO5, PO6, PSO1, PSO2
CO2	Learn different morphological characteristics for the identification of Fungi and *Actinomycetes*	R, U, Ap, An	PO4, PO2, PO3, PO5, PO6,PSO1, PSO2
CO3	Observe the structure and morphology of unicellular eukaryotes	R,U, Ap, An	PO2, PO5, PO6,PSO1, PSO2
CO4	Learn the techniques to isolate Nitrogen fixing bacteria	R, U, Ap, An, E	PO1, PO5, PO6,PSO1, PSO2
CO5	Learn different enumeration techniques for the evaluation of microbial load of samples	R, U, Ap, An, E	PO1, PO5, PO6,PSO1, PSO2
CO6	Demonstrate the detection of virulence factors for confirmation of pathogenicity	R,U, Ap, An, E	PO4, PO5, PO6,PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

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POs, PSOs and COs for the three years Integrated B.Sc. Program

Mapping of Practical – I & Practical – II CourseCOs with the POs and PSOs for B.Sc. (Microbiology) Programme

Programme Name: B.Sc. Microbiology Program Code: SIUSMIC

Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
3	SIUSMIC31	2.0	3	Biomolecules and Analytical Microbiology

CO. No.	Course Outcome of SIUSMIC31 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Understanding the different biomolecules and studying their estimation methods and evaluating the values by applying Biostatistics.	R, U, Ap, An, E	PO1, PO2, PO4, PO6, PSO2
CO2	Understanding the central dogma and genetic code as the basis of life, defining the different genetic elements and DNA mutations and studying their effects on the genetic code	R, U, An,	PO1, PO2, PO4, PO6, PSO1, PSO2
CO3	Understanding the principle and working of spectroscopic and electrophoretic techniques and their applications	R, U, Ap, An	PO4, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Programme Name: B.Sc. Microbiology Program Code: SIUSMIC

Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
3	SIUSMIC32	2.0	3	Environmental Microbiology

CO. No.	Course Outcome of SIUSMIC32 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Evaluate and compare methods of air sanitation and quality control	R, U, Ap An	PO3, PO4, PO5, PO6, PSO1, PSO2
CO2	Review of freshwater and sewage microbiology and understanding the methods of potability testing and sewage treatment	R, U, Ap, An,	PO3, PO4, PO5, PO6, PSO1, PSO2
CO3	Discussing the different soil cycles and evaluating their role in Geomicrobiology	R, U, An	PO3, PO4, PO5, PO6, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

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POs, PSOs and COs for the three years Integrated B.Sc. Program

Programme Name: B.Sc. Microbiology Program Code: SIUSMIC
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
3	SIUSMIC33	2.0	3	Advances in Microbiology and Medical Microbiology

CO. No.	Course Outcome of SIUSMIC33 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/PSO
CO1	Discriminate between the techniques of nanoparticles, biofilm and biosensor and comparatively evaluate their applications	R, U, Ap, An, E	PO1, PO2, PO4, PO6, PSO1
CO2	Study the epidemiological methods of disease and evaluate different diagnostic techniques in diagnostic microbiology	R, U, Ap, An,E	PO2, PO3, PO4, PO5, PSO1, PSO2
CO3	Distinguish between different types of immunity and review their role in Disease Control	R, U, Ap, An	PO2, PO3, PO4, PO5, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Programme Name: B.Sc. Microbiology Program Code: SIUSMIC
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
3	SIUSMICP3	3.0	9	Practical I, Practical II & Practical III

CO. No.	Course Outcome of SIUSMICP3 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Estimate quantitatively different biomolecules like carbohydrates, nucleic acids etc	R, U, Ap, An	PO2, PO4, PO5, PSO1, PSO2
CO2	Understand the principle and working of pH meter, UV spectrophotometer and electrophoresis.	R, U, Ap, An	PO2, PO4, PO5, PSO1, PSO2
CO3	Learn to analyze using different tests quality of waste water & air.	R, U, Ap, An,E	PO3, PO4, PO5, PO6, PSO1, PSO2
CO4	Learn to isolate Nitrosifiers, cellulose degraders, Phosphate solubilizes from different samples.	R, U, Ap, An, E	PO3, PO4, PO5, PO6, PSO1, PSO2
CO5	Use of different bacteriological media for isolation and identification of pathogenic bacteria from different samples.	R, U, Ap, An, E	PO2, PO3, PO4, PO5, PSO1, PSO2
CO6	Preparation and analysis of nanoparticle.	R, U, Ap, An,E	PO2, PO3, PO4, PO5, PSO1, PSO2
CO7	Use of immunological techniques to estimate concentration of antigen.	R, U, Ap, An,E	PO2, PO3, PO4, PO5, PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

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Department of Microbiology

POs, PSOs and COs for the three years Integrated B.Sc. Program

Programme Name: B.Sc. Microbiology Program Code: SIUSMIC
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
4	SIUSMIC41	2.0	3	Metabolism and Basic Analytical Techniques

CO. No.	Course Outcome of SIUSMIC41 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Understanding the principles of bioenergetics with respect to cellular metabolism	R, U, Ap, An, E	PO1, PSO2
CO2	Understanding the enzyme kinetics and determine the various factors affecting enzyme Kinetics	R, U, Ap, An, E	PO1, PO2, PSO2
CO3	Understanding the principle and working of chromatographic and centrifugation techniques and their applications	R, U, Ap, An	PO1, PO2, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Programme Name: B.Sc. Microbiology Program Code: SIUSMIC
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
4	SIUSMIC42	2.0	3	Industrial, Food and Dairy Microbiology

CO. No.	Course Outcome of SIUSMIC42 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Describe and understand basic fundamentals of industrial microbiology.	R, U, Ap	PO2, PO6, PSO1, PSO1,PSO2
CO2	Understanding the role of microbes in food microbiology with respect to food production, spoilage and preservation	R, U, Ap, An	PO2, PO6, PSO1, PSO1,PSO2
CO3	Defining the basics of dairy microbiology and applying the role of microbes to develop dairy products	R, U, Ap	PO2, PO6, PSO1, PSO1,PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

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Head, Department of Microbiology

SIES College of Arts Science and Commerce, (Autonomous), Sion (West)

Department of Microbiology

POs, PSOs and COs for the three years Integrated B.Sc. Program

Programme Name: B.Sc. Microbiology Program Code: SIUSMIC
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
4	SIUSMIC43	2.0	3	Microbial diversity, taxonomy and Applications of Microbiology

CO. No.	Course Outcome of SIUSMIC43 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Classifying microorganism based on taxonomic principles and evaluate the different methods of microbial taxonomy	R, U, Ap, An	PO1, PO2, PO4, PSO1, PSO2
CO2	Understanding extreme environment and comparing the microbial diversity and studying the applications of extremophiles	R, U, Ap	PO2, PO3, PO6,PSO1, PSO2
CO3	Evaluating the role of microbes as biofertilizers, biocontrol agents and remediation of polluted environment	R, U, Ap	PO2, PO3, PO6,PSO1, PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Programme Name: B.Sc. Microbiology Program Code: SIUSMIC
Expected Course Outcomes

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester	Course Code	Credits	Lectures/week	Course Name
4	SIUSMICP4	3.0	9	Practical I, Practical II& Practical III

CO. No.	Course Outcome of SIUSMICP4 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Analyze different kinetic parameters of a microbial enzyme	R, U, Ap, An	PO1, PO2, PO4, PO5, PSO1, PSO2
CO2	Application of chromatographic and centrifugation techniques for the separation of biomolecules	R, U, Ap, An	PO1, PO2, PO4, PO5, PSO1, PSO2
CO3	Critical analysis of concepts in bioenergetics	R, U, Ap, An	PO1, PO2, PO4, PSO2
CO4	Evaluation of milk quality by chemical and microbiological techniques	R, U, Ap, An	PO1, PO2, PO4, PO5, PSO1, PSO2
CO5	Learn and apply enrichment techniques for the isolation of extremophiles	R, U, Ap, An	PO1, PO2, PO4, PO5,PO6, PSO1, PSO2
CO6	Learn the use of Bergey's manual for the taxonomic classification of bacterial isolates	R, U, Ap, An	PO1, PO2, PO4, PO5, PO6 PSO1, PSO2

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Program: BSc Physics

Class: FYBSc and SYBSc

Program Outcomes

Program Specific Outcomes

Course Outcomes

4. Program Outcomes and Program Specific Outcomes
B.Sc. Physics

Upon completion of this undergraduate degree program, a student will be able to accomplish the following program outcomes.

NO.	Details
PO1.	**Solving Complex Problems:** Applying the knowledge of various courses learned under a program with an ability to break down complex problems into simple components, by designing processes required for problem solving. Cognitive Levels: An, Ap
PO2.	**Critical Thinking and reasoning ability:** Exhibits ability to understand abstract concepts,analyze, and apply them in problem solving. Ability to formulate and develop logical arguments. developing the ability to think with different perspectives and ideas. (Skills necessary for progression to higher education and research.) Cognitive Levels: U, An
PO3.	**Research Aptitude:** Acquiring the ability to explore and gain knowledge in independent ways through reading assignments, problem solving assignments, projects, seminars, presentations. Cognitive Levels: Ap, An, E, C
PO4.	**Proficiency with ICT**: Equip to select, apply appropriate tools and techniques, resources through electronic media for the purpose of visualizing mathematical objects, geometrical interpretations, coding, and analyzing data. Cognitive Levels: U, Ap
PSO1	Understand the basic concepts and fundamentals of mechanics, properties of matter, current electricity and electrodynamics
PSO2	Understand the basic of quantum mechanics, relativistic physics, nuclear physics, optics, atomic physics, solid state physics, statistical physics, thermodynamics, mathematical physics & biophysics
PSO3	Understand and apply the concepts of electronics in designing of different analog & digital circuits and also in instrumentation
PSO4	Understand the basics of computer programming, assembly language & numerical analysis.
PSO5	Apply and verify theoretical concepts through laboratory experiments
PSO6	Applications of theoretical concepts
PSO7	To get familiarized with current and recent scientific and technological developments
PSO8	To enrich knowledge through problem solving, hands on activities, study visits & projects

- To develop analytical abilities towards real world problems
- To familiarize with current and recent scientific and technological developments
- To enrich knowledge through problem solving hands on activities, study visits, projects etc.

5. Expected Course Outcomes: F.Y.B.Sc.

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. Theoutline of Course Learning Outcomes is described below.

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Semester 1

Course Code	Credits	Lectures/week	Course Name
SIUSPHY11	2	3	Mechanics & Properties of matter
	Unit1: Mechanics **Unit2: Compound pendulum & superposition of oscillations** **Unit3: Elasticity & Fluid Mechanics**		

Course outcome No.	Course Outcome of SIUSPHY11 Upon completion of this course, students will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Apply the basic concepts of Newtonian mechanics	U, AP	PSO6, PSO8
CO2	Define central force and its characteristics, and study gravitational force from the point of view of central force	U, R, AP	PSO1, PSO8
CO3	Apply basic ideas of pendulum to compound pendulum	U, R, AP,AN	PSO1, PSO6, PSO8
CO4	Study superposition of harmonic oscillation with necessary derivations.	U, R, AP,AN	PSO1, PSO6, PSO8
CO5	To Derive relation between elastic constants, torque per unit twist. Study bending of beams with relevant derivations.	U, R, AP,AN	PSO1, PSO6, PSO8
CO6	Derive equation of continuity, state and prove Bernoullie's theorem and derive Poiseullie's equation.	U, R, AP,AN	PSO1, PSO6, PSO8

Paper-II

Course Code	Credits	Lectures/week	Course Name
SIUSPHY12	2	3	Electricity & Electronics
	Unit1: DC circuit **Unit2: AC Circuits and BG** **Unit3: Basic Electronics**		

Course Code No	Course Outcome of SIUSPHY12 Upon completion of this course, students will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Discuss and derive the growth and decay of current in LR,CR, and LCR circuit	U, R,AP,AN	PSO1,PSO3,PSO 8

CO2	Discuss the basic circuit laws, examine different circuit using network theorems and applications of maximum power transfer theorem	U, R,AP,AN	PSO1,PSO8
CO3	Describe AC bridge concept with examples	U, R,AP,AN	PSO1,PSO8
CO4	Understand working, Sensitivity and damping of ballistic galvanometer	U, R	PSO1,PSO8
CO5	Categorized digital and analogue circuits. Convert from one number system to another, Understand logic gates with the help of truth table, Apply Boolean laws of logic expression.	AP, AN, C	PSO3, PSO6
CO6	Investigate binary arithmetic with the help of logic circuits.	AN, AP	PSO3,PSO8
CO7	Discuss the concept of rectification, calculation of ripple factor, efficiency and understand the voltage regulation	U, R, AP, AN	PSO3, PSO8

Practical				
Course Code	**Credits**	**Lectures/week**	**Course Name**	
SIUSPHYP1	**2**	**6**	**Physics Practical**	
Course Objective No	**DETAILS**		**Cognitive Level**	**Affinity with PO/ PSO**
CO1	To demonstrate experimental skills of Physics		U, R, AP	PSO3, PSO5, PSO6
CO2	To understand and practice experimental skills while doing Physics experiment		U, R, AP	PSO3, PSO5, PSO6
CO3	Use of apparatus and their use without fear.		UR, AP	PSO3, PSO5, PSO6
CO4	Correlating theoretical concepts through experiments		U, R, AN, E	PSO5, PSO8
CO5	To understand concept of error & its estimation		U, R	PSO6, PSO8

Expected Course Outcomes: F.Y.B.Sc.

Each course of the program aims at developing certain skills, attitudes and knowledge base of the students. The outline of Course Learning Outcomes is as described below.

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Semester 2

Course Code	Credits	Lectures/week	Course Name
SIUSPHY21	2	3	Optics, Modern Physics and Medical Physics
	Unit1: Optics		
	Unit2: Modern Physics		
	Unit3: Medical Physics		

Course outcome No.	Course Outcome of SIUSPHY21 Upon completion of this course, students will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Derive lens equation and study different types of magnification	U, R, AP, AN	PSO2, PSO8
CO2	Derive equivalent focal length and hence study the construction of different types of eye pieces.	U, R, AP	PSO2, PSO8
CO3	Examine different types of inherent defects in lens.	U, R, AP, AN	PSO2, PSO8
CO4	Describe the phenomenon of interference.	U, R, AP, AN	PSO2, PSO8
CO5	Outline the origin of quantum theory.	U, R, AP, AN	PSO2, PSO8
CO6	Describe the production of X-rays and X-ray spectra.	U, R, AP, AN	PSO2, PSO8
CO6	Outline basic biophysical terminology of human body.	U, R, AP	PSO2, PSO7, PSO8
CO7	To understand physics of human physiology.	U, R, AP	PSO2, PSO7, PSO8

PAPER -2

Course Code	Credits	Lectures/week	Course Name
SIUSPHY22	2	3	Vector algebra and Vector derivatives, Electrostatics & Magnetostatics
	Unit1: Vector Algebra and vector derivatives		
	Unit2: Electrostatics		
	Unit3: Magnetostatics		

Course outcome No.	Course Outcome of SIUSPHY22 Upon completion of this course, students will be able to	Cognitive Level	Affinity with PO/ PSO

CO1	To identify basic components of vector algebra.	**U, R, AP, AN**	**PSO2, PSO8**
CO2	To explain types of vector products and their applications.	**U, R, AP, AN**	**PSO2, PSO8**
CO3	To explain del operator and to illustrate its different applications.	**U, R, AP, AN**	**PSO2, PSO8**
CO4	To explain Gauss's law and its applications to determine electric fields.	**U, R, AP, AN**	**PSO2, PSO8**
CO5	To discuss and determine the electrostatic potential and PE in different systems.	**U, R, AP, AN**	**PSO2, PSO8**
CO6	To discuss and determine magnetic field in different systems.	**U, R, AP, AN**	**PSO2, PSO8**
CO7	To study the curl and div of magnetic field in sstmes and compare with electric fields	**U, R, AP, AN**	**PSO2, PSO8**

Practical Course

Course Code	**Credits**	**Lectures/week**	**Course Name**
SIUSPHYP2	**2**	**3**	**Practical II**

Course outcome No.	**Course Outcome of SIUSPHY22** **Upon completion of this course, students will be able to**	**Cognitive Level**	**Affinity with PO/ PSO**
CO1	To understand and practice the skills while doing physics practical.	**U, AP**	**PSO5, PSO6**
CO2	To understand the use of apparatus and their use without fear.	**U, AP**	**PSO5, PSO6**
CO3	To correlate their physics theory concepts through practical.	**U, AP, AN**	**PSO5, PSO 6**
CO4	Understand the concept of errors and their estimation.	**U, AP, AN**	**PSO4, PSO5, PSO 6**

6. Expected Course Outcomes: S.Y.B.Sc.

Semester	Course Code	Credits	Lectures/week	Course Name
3	SIUSPHY31	2	3	Mechanics

Unit1. Basic Mechanics
Unit2. Waves and Oscillations
Unit3. Coupled Oscillations & Non- linear mechanics

CO. No.	Course Outcome of SIUSPHY31 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	To introduce concept of CM frame and Laboratory frames of reference	R U An	PSO1 PSO2 PO1
CO2	To study two body collisions in CM frame and Laboratory frames of reference	U Ap An	PO1 PO2 PSO1
CO3	To study moving system with variable mass.	U Ap An	PO3 PO1 PSO6 PSO8
CO4	To study Angular momentum of a system of particles.	U Ap An	PO1 PO3 PSO6 PSO8
CO5	To derive basic equations for progressive waves.	R U Ap E	PO1 PO3 PSO8
CO6	To understand concepts of group velocity and phase velocity	U Ap An	PO3 PSO8 PO1
CO7	To study damped vibrations, forced vibrations and resonance.	U Ap An C	PO2 PO3 PSO8
CO8	To study coupled oscillations and types of coupling.	U Ap C	PO2 PO1 PO3 PSO1
CO9	Introduction to Nonlinear dynamics leading to concept of chaos.	U Ap An R	PSO7 PSO6 PSO8

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Semester	Course Code	Credits	Lectures/week	Course Name
3	SIUSPHY32	2	3	Electronics & Communication

Unit1. Bi-junction Transistors and Applications
Unit2. Transistors Oscillators and Opamp Applications
Unit3. Digital Electronics and Communication

CO. No.	Course Outcome of SIUSPHY32 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	To study construction and characteristics of bipolar junction transistors	R U	PSO3 PSO6
CO2	To discuss different types of transistor amplifiers and to derive expressions for their current, voltage and power gains	U Ap An	PSO3 PO1
CO3	To study effects of feedback in amplifiers with respect to I/P and O/P impedance, gain, stability, distortion and noise.	R U	PSO3 PSO6
CO4	To study different types of transistor oscillators	R U Ap	PSO3 PO1
CO5	To study characteristics and applications of opamps	R U Ap	PSO3 PSO6
CO6	To study different types of flip-flops.	R U	PSO3 PSO6
CO7	To understand concept of embedded systems	R U	PSO3 PSO6
CO8	To study AM and FM in communication.	R U	PSO3 PSO6
CO9	To acquire quantitative problem solving skill in all the topics covered	Ap An	PSO3 PO1 PO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Semester	Course Code	Credits	Lectures/week	Course Name
3	SIUSPHY33	2	3	Mathematical Physics & Theory Of errors
	Unit1. Vector Calculus **Unit2. Differential Equations** **Unit3. Theory of errors**			

CO. No.	Course Outcome of SIUSPHY33 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	To understand different types of vector integrals and related fundamental theorems.	R U Ap	PSO2 PSO6
CO2	To discuss different types of curvilinear coordinates and relations among them.	R U Ap	PO1 PSO2
CO3	To identify different types of differential equations and apply appropriate techniques to obtain their solutions.	R U Ap	PSO2 PSO6
CO4	To construct differential equations for some practical examples such as LR and CR circuits and obtain their solutions.	Ap An	PO1
CO5	To understand elementary theory of errors.	U Ap	PO1 PSO6

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Semester	Course Code	Credits	Lectures/week	Course Name
3	SIUSPHYP3	3	6	**Practical course -3**
	Practical based on all the three theory courses SIUSPHY31/32/33			

CO. No.	Course Outcome of SIUSPHYP3 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	To use breadboard for designing and testing electronic circuits	Ap C	PSO5 PSO3
CO2	To practice use of different measuring instruments like CRO, BG.	Ap C E	PSO3 PSO5
CO3	Correlate the concepts of physics with experimental outcomes.	An C E	PSO3 PSO5 PSO8
CO4	Concepts of errors, their estimation and significance.	An E	PSO8 PSO5
CO5	To plan and execute short projects.	U Ap An C	PSO4 PSO8 PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Semester	Course Code	Credits	Lectures/week	Course Name
4	SIUSPHY41	2	3	**Thermodynamics**
	Unit1. Zeroth and first law of thermodynamics and engines **Unit2. Second law of thermodynamics and entropy** **Unit3. Third law of thermodynamics and Thermodynamic engines**			

CO. No.	Course Outcome of SIUSPHY41 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	To understand Zeroth Law and basic concepts of Thermodynamics	R U An	PO2 PSO1 PSO2
CO2	To study ideal thermodynamic engine.	U An C	PSO6 PSO8 PSO2
CO3	To determine work done in different types of processes.	U An Ap C	PO3 PSO6 PSO2
CO4	To understand concept of entropy of a system and its significance.	R U An	PO2 PSO1 PSO2

CO5	To derive Maxwell's Thermodynamic relations and its applications.	R U An Ap	PSO8 PSO6 PSO2
CO6	To study different types of heat engines and their efficiency.	U An Ap C	PSO8 PSO2

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Semester	Course Code	Credits	Lectures/week	Course Name
4	SIUSPHY42	2	3	Quantum Mechanics

Unit1. The Schrodinger wave equation
Unit2. Applications of Schrodinger steady state equation-I
Unit3. Applications of Schrodinger steady state equation – II

CO. No.	Course Outcome of SIUSPHY42 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	To understand concepts of wave function and operators.	R U An	PSO2 PSO8
CO2	To apply concepts of eigen values and eigen functions.	U An Ap	PSO2 PSO6
CO3	To derive time dependent and time independent (Steady State) Schrodinger equations.	R U An	PO2 PSO2
CO4	To apply time independent Schrodinger equation to various problems.	R U An Ap	PO2 PO3 PSO2
CO5	To apply time independent Schrodinger equation to barrier potential problem.	U An Ap	PSO2 PSO8
CO6	To understand tunneling effect and its application to alpha particle decay.	U An Ap E	PSO2 PSO5
CO7	To study Harmonic oscillator and its solution by operator method.	U An Ap	PSO2 PSO8

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Semester	Course Code	Credits	Lectures/week	Course Name
4	SIUSPHY43	2	3	Optics And Lasers

UNIT 1: Diffraction
UNIT II: Polarization
UNIT III: Resolving Power and Lasers

CO. No.	Course Outcome of SIUSPHY43 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	To understand Fresnel and Fraunhoffer diffraction.	R U	PO2 PSO2
CO2	To understand Fresnel diffraction pattern due to straight edge, narrow slit and thin wire.	U Ap	PO2 PSO2 PO3 PSO5
CO3	To understand Fraunhoffer diffraction pattern due to double slit and plane grating.	U Ap	PO2 PSO2 PO3 PSO5
CO4	To understand concept of polarization of light.	R U Ap	PSO2 PO3 PSO5
CO5	To derive Brewster's Law.	R U	PO2 PSO2
CO6	To know different methods of production of polarized light.	R U	PO2 PSO2
CO7	To understand uses of Quarter wave plate, Half wave plate.	R U	PO2 PSO2
CO8	To understand concept of Rayleigh's criterion of resolution.	U Ap	PO2 PSO2 PO3 PSO5
CO9	To derive expressions for R.P. of a prism, plane transmission grating and telescope.	U An Ap	PO2 PO3 PSO5
CO10	To study different sources and applications of LASER.	R U Ap	PO2 PSO2 PO3 PSO5

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Semester	Course Code	Credits	Lectures/week	Course Name
4	SIUSPHYP4	3	6	Practical Course -4
	Practical based on Courses SIUSPHY41, SIUSPHY42, SIUSPHY43			

CO. No.	Course Outcome of SIUSPHYP4 Upon completion of this course, student will be able to	Cognitive Level	Affinity with PO/ PSO
CO1	Data Analysis using PC (Least square fitting).	U An Ap E	PO4 PSO5
CO2	To use of spectroscopic techniques in experiments.	U An Ap	PSO6 PSO5
CO3	To use PC simulations to demonstrate various experiments.	U An Ap E	PSO5 PO4 PSO4
CO4	Correlate the concepts of physics with experimental outcomes.	U An E	PSO5 PO1
CO5	Concepts of errors and their estimation.	An Ap E	PSO5 PSO6
CO6	To get exposure to novel experimental techniques used in industries and research institutes.	An Ap E	PO4 PSO5 PSO8

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Program: BSc Statistics

Class: FYBSc and SYBSc

Program Outcomes

Program Specific Outcomes

Course Outcomes

Program Name: B.Sc. Statistics

The Program is structured into 6 semesters.

Semesters 1 and 2

Students have to select 3 subjects of their choice in each semester. The subject of Foundation Course is compulsory in each semester. A student who has selected Statistics as one of his subjects, studies two Theory courses, one Practical course in each of the semesters 1 and 2.

Semesters 3 and 4

Students have to select 2 subjects from the subjects they studied in semesters 1 and 2. The subject of Foundation Course is compulsory in each semester. A student who has selected Statistics as one of his subjects, studies 3 Theory courses, one Practical course in each of the semesters 3 and 4.

Structure of the Program

Semester & Class	Course Code	Course Name	Lectures per week	Credits per Semester	Total number of lectures per unit
FYBSc SEM 1	**SIUSSTA11**	**DESCRIPTIVE STATISTICS I**	**3**	**2**	**15**
	Unit 1	**TYPES OF DATA AND DATA CONDENSATION**			
	Unit 2	**MEASURES OF CENTRAL TENDENCY**			
	Unit 3	**MEASURES OF DISPERSION, SKEWNESS & KURTOSIS**			
	SIUSSTA12	**STATISTICAL METHODS I**	**3**	**2**	**15**
	Unit 1	**ELEMENTARY PROBABILITY THEORY**			
	Unit 2	**RANDOM VARIABLES**			
	Unit 3	**STANDARD DISCRETE DISTRIBUTIONS**			

	SIUSSTAP1	**PRACTICAL BASED ON:**	**6**	**2**	
	SIUSSTA11	**DESCRIPTIVE STATISTICS I**	**3**		
	SIUSSTA12	**STATISTICAL METHODS I**	**3**		
FYBSc SEM 2	**SIUSSTA21**	**DESCRIPTIVE STATISTICS II**	**3**	**2**	**15**
	Unit 1	**CORRELATION & REGRESSION ANALYSIS**			
	Unit 2	**TIME SERIES**			
	Unit 3	**VITAL STATISTICS**			
	SIUSSTA22	**STATISTICAL METHODS II**	**3**	**2**	**15**
	Unit 1	**STANDARD CONTINUOUS DISTRIBUTIONS**			
	Unit 2	**ESTIMATION**			
	Unit 3	**TESTING OF HYPOTHESIS AND LARGE SAMPLE TESTS**			
	SIUSSTAP2	**PRACTICALS BASED ON**	**6**	**2**	
	SIUSSTA21	**DESCRIPTIVE STATISTICS II**	**3**		
	SIUSSTA22	**STATISTICAL METHODS II**	**3**		
SYBSc SEM 3	**SIUSSTA31**	**PROBABILITY DISTRIBUTIONS**	**3**	**2**	15
	Unit 1	**UNIVARIATE RANDOM VARIABLES (DISCRETE & CONTINUOUS)**			
	Unit 2	**STANDARD DISCRETE PROBABILITY DISTRIBUTIONS**			
	Unit 3	**BIVARIATE PROBABILITY DISTRIBUTIONS**			
	SIUSSTA32	**THEORY OF SAMPLING**	3	2	15

	Unit 1	**CONCEPTS OF SAMPLING & SIMPLE RANDOM SAMPLING**			
	Unit 2	**STRATIFIED SAMPLING**			
	Unit 3	**RATIO & REGRESSION ESTIMATION AND SAMPLING METHODS**			
	SIUSSTA33	**OPERATIONS RESEARCH I**	3	2	15
	Unit 1	**LINEAR PROGRAMMING PROBLEMS**			
	Unit 2	**TRANSPORTATION PROBLEMS**			
	Unit 3	**ASSIGNMENT PROBLEMS & SEQUENCING**			
	SIUSSTAP3	**PRACTICALS BASED ON**	9	3	
	SIUSSTA31	**PROBABILITY DISTRIBUTIONS**	3		
	SIUSSTA32	**THEORY OF SAMPLING**	3		
	SIUSSTA33	**OPERATIONS RESEARCH I**	3		
SYBSc SEM 4	**SIUSSTA41**	**PROBABILITY AND SAMPLING DISTRIBUTIONS**	3	2	15
	Unit 1	**STANDARD CONTINUOUS PROBABILITY DISTRIBUTIONS**			
	Unit 2	**NORMAL DISTRIBUTION**			
	Unit 3	**EXACT SAMPLING DISTRIBUTIONS**			
	SIUSSTA42	**ANALYSIS OF VARIANCE & DESIGNS OF EXPERIMENTS**	3	2	15
	Unit 1	**ANALYSIS OF VARIANCE**			
	Unit 2	**DESIGNS OF EXPERIMENTS**			
	Unit 3	**LATIN SQUARE DESIGNS & FACTORIAL EXPERIMENTS**			

	SIUSSTA43	**OPERATIONS RESEARCH II**	3	2	15
	Unit 1	**CPM & PERT**			
	Unit 2	**GAME THEORY**			
	Unit 3	**DECISION THEORY**			
	SIUSSTAP4	**PRACTICALS BASED ON**	9	3	
	SIUSSTA41	**PROBABILITY AND SAMPLING DISTRIBUTIONS**	3		
	SIUSSTA42	**ANALYSIS OF VARIANCE & DESIGNS OF EXPERIMENTS**	3		
	SIUSSTA43	**OPERATIONS RESEARCH II**	3		

Program Name: B.Sc. Statistics

Program Outcomes and Program Specific Outcomes

At the completion of the undergraduate program, the student will be able to accomplish the following program outcomes.

POS	Statements
PO1.	**Solving Complex Problem:** Applying the knowledge of various courses learned under a program with an ability to break down complex problems into simple components by designing processes required for problem solving.
PO2.	**Critical Thinking:** Organizing thoughts to identify assumptions, verify the accuracy and validity of assumptions, make informed decisions that guide actions (at Institutional, Personal and Intellectual level), develop the ability to think with different perspectives and ideas.
PO3.	**Reasoning ability and Rational thinking:** Developing rational thinking on the basis of acquired contextual knowledge, assessing societal public health and safety, cultural, legal, gender, ethnic and environmental issues, and performing with decisive responsibility.

PO4.	**Research skill:** Utilizing the contextual knowledge in an interdisciplinary framework. Integrating research-based knowledge and research methods involving problem definition, analysis and interpretation of data, synthesis of the information to provide valid conclusions. Exercising analytical skill, research ability, creativity, for employability and collaborating with industries.
PO5.	**Proficiency with ICT**: Equipping to create, select, apply appropriate tools and techniques, resources through electronic media for the purpose of gathering, analyzing data and drawing inference with an understanding of its merits and demerits.
PO6.	**Social Interactive Skills and teamwork:** Eliciting networking with people, mediate disagreement and help reach conclusions in group settings. Functioning effectively as an individual, and as a member in diverse groups, and in multidisciplinary settings exhibiting adaptability, leadership quality and team building.
PO7.	**Self-directed and Life-long Learning:** Acquiring the ability to explore and gain knowledge in independent ways, keep evolving life-long in the broad context of socio-technological changes.
PO8.	**Ethical values:** Recognizing and respecting different value systems including one's own, to understand the moral dimensions of one's decisions, intention being to help the society and feeling good about it, commitment to professional duties and responsibilities.

	PROGRAMME SPECIFIC OUTCOMES
PSO1.	Ability to recognize the importance and value of statistical thinking, training and approach to problem solving.
PSO2.	Recognize and appreciate the connection between theory and application in a variety of disciplines.
PSO3.	Confidence to review statistical literature available through/in survey articles, scholarly books, and online sources.
PSO4.	Ability to use statistical techniques and work effectively in analytics, scientific,financial, actuarial, pharmaceutical, technical, and other positions of government/non-government organizations.
PSO5.	Scope for students to pursue academic research to widen the domain of the subject.

Course Outcomes: B.Sc. Statistics

Each course of the program aims at developing certain skills, attitudes, and knowledge base of the students. The outline of Course Learning Outcomes is described below.

Semester 1: Course Outcomes

Course Code:		SIUSSTA11	Course Name:	Descriptive Statistics I	
Semester	1	Credits	2	Lectures per week	3

CO. No.	Course Outcome of SIUSSTA11 Upon completion of this course, student will be able to	Affinity with PSO	Cognitive Level
1	Learn various data collection methods and present the data in tabular and graphical forms.	PSO 2,4	U, Ap, E &C
2	Calculate the various measures of central tendency used in analyzing data.	PSO 2,4,5	R, U, Ap &An
3	Select appropriate graphical method to present the data.	PSO 2,4	U, Ap, E &C
4	Choose appropriate averages for different data sets.	PSO 2,4,5	R, U, Ap &An
5	Acquire information about various Statistical organizations in India and their functions. Analyze data based on attributes and interpret the results	PSO 1,4	R, U, Ap &An

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Course Code:		SIUSSTA12	Course Name:	Statistical Methods I	
Semester	1	Credits	2	Lectures per week	3

CO. No.	Course Outcome of SIUSSTA12 Upon completion of this course, student will be able to	Affinity with PSO	Cognitive Level
1	Understand the concept of probability and apply problem solving techniques in real life events.	PSO 1,2,4,5	R, U, Ap &E
2	Understand the concept of random variables. Compute the probability mass/density function and cumulative distribution function. Study properties of distribution.	PSO 1,2,4,5	R, U, & Ap
3	Identify and apply standard discrete probability distributions to different situations.	PSO 1,2,4,5	R, U, & Ap

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Course Code:		SIUSSTAP1	Course Name:	Practical Based on Paper 1 and Paper 2	
Semester	2	Credits	2	Lectures per week	3

CO. No.	Course Outcome of SIUSSTAP1 Upon completion of this course, student will be able to	Affinity with PSO	Cognitive Level
1	Construct various diagrams to represent data and interpret.	PSO 1,2,4	U, Ap, E & C
2	Compute various measures of central tendency, dispersion, skewness and kurtosis, correlation, and regression coefficients	PSO 1,2,4	R, U & Ap
3	Analyze data pertaining to discrete variables and interpret the results. Compute probabilities of bivariate distributions	PSO 1,2,4	R, U & Ap
4	Finding Probability values in different situations for problem solving	PSO 1,2,3,4,5	R, U, An & Ap
5	Calculate the probabilities based on discrete variables and distributions.	PSO 1,2,3,4,5	R, U & Ap

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome ;

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Semester 2: Course Outcomes

Course Code:		SIUSSTA21	Course Name:	Descriptive Statistics II	
Semester	2	Credits	2	Lectures per week	3

CO. No.	Course Outcome of SIUSSTA21 Upon completion of this course, student will be able to	Affinity with PSO	Cognitive Level
1	Understand the concept of correlation and regression and its applications in various fields viz. Agriculture, Business, Medical Science, Industry, etc.	PSO 1,2,3,4	R, U, Ap & An
2	Analyze the time-related data using forecasting techniques.	PSO 1,2,3,4	R, U, Ap & An
3	Understand the concepts of vital statistics and calculate reproduction rate, birth rate and death rate.	PSO 1,2,3,4	R, U, Ap & An

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Course Code:		SIUSSTA22	Course Name:	Statistical Methods II	
Semester	2	Credits	2	Lectures per week	3

CO. No.	Course Outcome of SIUSSTA22 Upon completion of this course, student will be able to	Affinity with PSO	Cognitive Level
1	Identify standard continuous distributions and use the properties in real life situations.	PSO 1,2,3,4	R, U & Ap
2	Understand concept of Estimation and find estimators and confidence intervals of parameters.	PSO 1,2,3,4	R, U & Ap
3	Understand and apply the concept of testing of hypothesis. Test the validity of given statements about population parameters.	PSO 1,2,3,4	R, U & Ap

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome ;

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Course Code:		SIUSSTAP2	Course Name:	Practical Based on Paper 1 and Paper 2	
Semester	3	Credits	2	Lectures per week	6

CO. No.	Course Outcome of SIUSSTAP2 Upon completion of this course, student will be able to	Affinity with PSO	Cognitive Level
1	Compute correlation and regression based on different independent and dependent variables.	PSO 1,2,4	R, U, Ap & E
2	To compute future value based on the time related data using concept of Time series.	PSO 1,2,4	R, U, Ap & E
3	Solve problems based on vital statistics and interpret them.	PSO 1,2,4	R, U & Ap
4	Calculate probabilities based on continuous variables and distributions.	PSO 1,2,3,4	R, U & Ap
5	Solve problems based on Estimation.	PSO 1,2,3,4	R, U & Ap
6	Compute probabilities of different types of error using testing of hypothesis theory. Analyze the data based on large sample and proportions.	PSO 1,2,3,4	R, U & Ap

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome.

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Semester 3: Course Outcomes

Course Code:		SIUSSTA31	Course Name:	Probability Distributions	
Semester	3	Credits	2	Lectures per week	3

CO. No.	Course Outcome of SIUSSTA31 Upon completion of this course, student will be able to	Affinity with PSO	Cognitive Level
1	Understand the concept and derivation of moment generating function, cumulant generating function, characteristic function, joint probability mass functions, marginal densities, conditional distributions.	PSO 1,2,3, 4	R, U & Ap
2	Study different discrete distributions and the relationship between them using the transformation of random variables.	PSO 1,2,3 4	R, U & Ap

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Course Code:		SIUSSTA32	Course Name:	Sampling Techniques	
Semester	3	Credits	2	Lectures per week	3

CO. No.	Course Outcome of SIUSSTA32 Upon completion of this course, student will be able to	Affinity with PSO	Cognitive Level
1	Learn basic concepts involved in sampling theory.	PSO 1,2,3 4	R, U, Ap & E
2	Access various sampling methods available to estimate parameters of the population.	PSO 1,2,3 4	R, U, Ap & E
3	Examine the various properties of the estimators in each sampling scheme.	PSO 1,2,3 4	R, U & An
4	Compare estimators of a population parameter with a view to select an appropriate one.	PSO 1,2,3 4	R, U & An

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Course Code:		SIUSSTA33	Course Name:	Operations Research 1	
Semester	3	Credits	2	Lectures per week	3

CO. No.	Course Outcome of SIUSSTA33 Upon completion of this course, student will be able to	Affinity with PSO	Cognitive Level
1	Demonstrate the knowledge of basic concepts of Operations Research (OR) and its application to various industrial situations. He/ She will have the ability to formulate and solve Linear Programming problem to obtain optimal results.	PSO 1,2,4	R, U, Ap &C
2	Apply contextual knowledge to solve problems based on transportation to achieve an optimal solution.	PSO 1,2,4	R, U & Ap
3	Identify and categorize problems of assignment, travelling salesman and sequencing and solve themfor optimization of resources.	PSO 1,2,4	U, Ap & E
4	Learn to use Excel Solver and hence solve different types of LPP problems.	PSO 1,2,4	R, U & Ap
5	Solve assignment and transportation problems using TORA.	PSO 1,2,4	R, U & Ap

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Course Code:		SIUSSTAP3	Course Name:	Practical Based on Paper 1,2 & 3	
Semester	3	Credits	3	Lectures per week	9

CO. No.	Course Outcome of SIUSSTAP3 Upon completion of this course, student will be able to	Affinity with PSO	Cognitive Level
1	Identify skewness and kurtosis of different standard discrete distributions using Moment generating function, Cumulant generating function & Characteristic function.	PSO 1,2,4	R, U & Ap
2	Design a questionnaire on different topics.	PSO 1,2,4	R, U, Ap & C
3	Estimate parameters and confidence interval for estimators for different sampling schemes. Compare the different sampling schemes and determine the sample size.	PSO 1,2,4	R, U, Ap &E
4	Understand industry problems like transportation etc.	PSO 1,2,4	R, U & Ap

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Semester 4: Course Outcomes

Course Code:		SIUSSTA41	Course Name:	Probability and Sampling Distributions	
Semester	4	Credits	2	Lectures per week	3

CO. No.	Course Outcome of SIUSSTA41 Upon completion of this course, student will be able to	Affinity with PSO	Cognitive Level
1	Study different continuous distributions and therelationship between them using the transformation of random variables.	PSO 1,2,3,4	R, U & Ap
2	Outline the properties and Uses of Normal Distribution and their interpretation.	PSO 1,2,3 4	R, U & Ap
3	Implement the concept of sampling distributions and their applications in statistical inference, hypothesis testing and draw conclusions.	PSO 1,2,3, 4	R, U, Ap & An
4	Examine relationship between normal, t, F and chi-square variates.	PSO 1,2,3, 4	R, U, Ap

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Course Code:		SIUSSTA42	Course Name:	Analysis of Variance & Design of Experiments	
Semester	4	Credits	2	Lectures per week	3

CO. No.	Course Outcome of SIUSSTA42 Upon completion of this course, student will be able to	Affinity with PSO	Cognitive Level
1	Evaluate the data collected using ANOVA techniques using one way and two-way classification of the attributes.	PSO 1,2,3,4	U, Ap, An & E
2	Design an experiment for specified objectives and estimate parameters using ANOVA.	PSO 1,2,3,4	R, U, Ap
3	Compare the designs based on efficiency.	PSO 1,2,3,4	R, U, Ap
4	Estimate the missing observations in the designs of experiment.	PSO 1,2,3,4	R, U, Ap & E
5	Examine and analyze 2^2 and 2^3 Factorial experiments.	PSO 1,2,3,4	R, U, Ap & An

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome.

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Course Code:		SIUSSTA43	Course Name:	Operations Research II	
Semester	4	Credits	2	Lectures per week	3

CO. No.	Course Outcome of SIUSSTA43 Upon completion of this course, student will be able to	Affinity with PSO	Cognitive Level
1	Demonstrate the knowledge of basic concepts of PERT& CPM – Techniques of Project management and its application in the co-ordination of various jobs of a project.	PSO 1,2,3,4	R, U, Ap & C
2	Apply knowledge of game theory strategies to improve decision making.	PSO 1,2,3,4	R, U, Ap
3	Arrive at rational choices and take appropriate decisions that are most advantageous in situations of uncertainty.	PSO 1,2,3,4	R, U, Ap & An

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Course Code:		SIUSSTAP4	Course Name:	Practical based on Papers 1, 2 & 3	
Semester	4	Credits	3	Lectures per week	9

CO. No.	Course Outcome of SIUSSTAP4 Upon completion of this course, student will be able to	Affinity with PSO	Cognitive Level
1	Understand and apply the applications of Exact sampling distributions.	PSO 1,2,3,4	U & Ap
2	Compare different types of designs using ANOVA.	PSO 1,2,3,4	U, Ap & E
3	Understand planning and evaluation of project	PSO 1,2,3,4	U, Ap & C
4	Acquire skills in strategy planning and decision making	PSO 1,2,3,4	U, Ap & C

PO- Program Outcome, PSO-Program Specific outcome; CO-Course Outcome;

Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Head of the Department
Pallavi Rege

Program: BSc Zoology

Class: FYBSc and SYBSc

Program Outcomes

Program Specific Outcomes

Course Outcomes

SIES College of Arts, Science and Commerce (Autonomous)
Sion (West), Mumbai – 400 022

Programme: Bachelor of Science, B.Sc. – Zoology

"I cannot teach anybody anything, I can only make them think" - Socrates

The characteristic graduate attributes comprising of Programme Outcomes, Programme Specific Outcomes and Course Outcomes for a science graduate in the subject of Zoology are as follows:

Note the list of abbreviations:
PO: Programme Outcome, PSO: Programme Specific Outcome, CO: Course Outcome
Cognitive Levels:- R: Remember, U: Understand, Ap: Apply, An: Analyze, E: Evaluate, C: Create

Serial Number	**Details of Programme Outcomes (POs)**
PO1 *(Skill Level)*	Problem Solving Ability *(U, Ap)* • Apply the knowledge of various courses learned under a program to break down complex problems into simple components. • Adopt and assimilate problem-based learning models and apply one's learning to solve real life problem situations.
PO2 *(Skill Level)*	Critical Thinking *(U, An, E)* • Develop critical thinking based on a rationale to identify assumptions, verifying the accuracy and validity of assumptions, and making informed decisions. • Inculcate the ability of logical reasoning to question the rationale behind concepts, ideas, and perspectives.
PO3 *(Skill Level)*	Effective Communication Skills *(Ap, C)* • Improve written and oral communication skills so as to express thoughts and ideas effectively. • Demonstrate the ability to listen carefully and imbibe soft skills to convey and receive instructions clearly. • Develop presentation skills to present complex information in a clear, lucid and concise manner.
PO4 *(Skill Level)*	Proficiency with Information and Communication Technology *(U, An, E)* • Demonstrate ability to access, evaluate and use a variety of relevant information resources inclusive of internet and electronic media for the purpose of collating and analysing data. • Understand the scope and limitations of tools or software's used in Information and Communication Technology.
PO5 *(Skill Level)*	Leadership Skills and Team Work *(U, Ap, An, C)* • Demonstrate leadership skills formulating an inspiring vision, thereby building a team, motivating and inspiring team members to engage and achieve that vision. • Develop management skills to guide people in takings tasks to their logical conclusion. • Inculcate the ability to facilitate coordinated effort as a group or team in the interests of common cause and recognise the contribution of team members.
PO6 *(Attitude Level)*	Self-directed and Lifelong Learning *(U, Ap, An)* • Demonstrate the ability to work independently and take responsibility for ones actions. • Acquire the ability to explore and evolve by becoming self-sufficient and self-reliant. • Adapt lifelong learning approaches to broaden one's horizons for personal growth

	and development.
PO7 *(Attitude Level)*	Ethical Values and Environmental Concerns *(U, Ap, E)* • Embrace moral or ethical values in conducting one's life and implement ethical practices in all aspects of life. • Create awareness and concern for environmental and sustainability issues. • Understand and realize the significance and relevance of co-habitation and co-evolution in attaining the needs of sustainable development.
PO8 *(Attitude Level)*	Gender Sensitization and Community Service *(U, Ap, An)* • Respect gender sensitivity, gender equity and gender justice. • Encourage mutual understanding and express empathetic social concern towards different value systems and different strata of society. • Engage in community service through Institutional Social Responsibility.

Serial Number	**Details of Programme Specific Outcomes (PSOs)**
PSO1	Conceptual Understanding and Emerging Applications *(R, U, Ap, An)* • Inculcate conceptual and coherent understanding of zoology, and demonstrate a broad understanding of animal diversity, including fundamental and systematic knowledge of the scientific classification, taxonomy and evolutionary relationships of major groups of animals. • Understand the nature and basic concepts of cell biology, biochemistry, animal physiology, molecular biology, ecology among other topics, so as to recognize the relationships between structure and functions at different levels of biological organization for the major groups of animals. • Demonstrate interest in different areas of zoology so as to analyse the scope of emerging applications of biological sciences in medicine, genetics, wild life, etc and apply appropriate methodologies with cutting edge tools/techniques in biological sciences to seek solutions to emerging problems faced by mankind. • Demonstrate the relevance of the procedural subject knowledge that creates different types of professionals related to the disciplinary/subject area of zoology, including professionals engaged in research and development, teaching and government/public service.
PSO2	Analytical reasoning and Scientific Inquiry *(U, An, E)* • Inculcate a sense of inquiry and capability for asking relevant or appropriate questions, articulating problems or concepts or questions. • Encourage the ability to analyse, interpret and draw conclusions from qualitative/quantitative data and critically evaluate ideas, experiences, theories and concepts by following scientific approach to knowledge development from an open minded and reasoned perspective. • Develop analytical skills involving paying attention to detail and imbibe the ability to construct logical arguments using correct technical language related to the relevant subject. • Analyse and interpret data/information collected or related to experiments or investigations, using appropriate methods involving Biostatistics, Bioinformatics among others and report accurately the findings of the experiment/investigations while relating the conclusions/ findings to relevant theories of zoology.
PSO3	Laboratory Skills and Fieldwork *(R, U, E, C)* • Understand and apply standard operating procedures as per Good Laboratory Practices so as to develop laboratory skills and qualities required for successful career in teaching, research, industry, etc. • Demonstrate awareness regarding animal ethics, human ethics, conservation of flora and fauna, so as to promote safe environment and ecosystem, in the pursuit of disciplinary knowledge.

	• Develop instrumentation handling skills and laboratory techniques relevant to academia and industry, integrate knowledge, skills with technical competency, so as to create solutions for issues and problems related to biological sciences. • Demonstrate leadership qualities, command trust and respect, thereby, motivating and inspiring team members to work effectively in diverse teams during excursions or study tours. Realise the relevance of participation in field studies in the context of teamwork as well as life on the outdoors.
PSO4	Research Aptitude and Interdisciplinary Approach *(Ap, An, E, C)* • Inculcate and adapt to research aptitude and culture, integrate research-based knowledge in an interdisciplinary framework, and realise the relevance of choosing research as an alternative career option. • Demonstrate the awareness regarding compliance with research ethics, awareness about conflicts of interests and Intellectual Property Rights, and avoiding unethical behaviour such as fabricating, falsifying or misrepresenting data or to committing plagiarism. • Inculcate the ability to recognise cause and effect relationships, formulate hypothesis, reporting the results of an experiment or investigation, and application of research tools for analysis and interpretation of data. • Inculcate an interdisciplinary approach, to understand and consolidate fundamental concepts through inquiry based curriculum, develop critical thinking and problem solving ability required to solve different types of biology related problems with well-defined solutions, and tackle open-ended problems that may cross disciplinary-area boundaries.

Course Outcomes for FYBSc

At the root of all (science) education (Core Learning Outcome):

"The imaginative and original mind need not be overawed by the imposing body of present knowledge or by the complex and costly paraphernalia which today surround much of scientific activity. The great shortage in science now is not opportunity, manpower, money, or laboratory space. What is really needed is more of that healthy scepticism which generates the key idea – the liberating concept." *– P.H. Abelson*

Purity of mind leads to clarity in thought and action for creation of an original archaic work.
As well, to consciously attempt the basic pursuit of understanding human existence.

Semester I – Theory

Course Code: SIUSZO11
Course Name: Diversity of Animal Kingdom - I, Life Processes - I and Ecology
The study of this course will accomplish the following outcomes:

Unit	Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
Unit 1: Diversity of Animal Kingdom - I	**CO1:** Understand animal diversity – variation in animal life, at elementary level to attempt an explanation of the experience of the animal world around. Spark the sensitive curiosity of zoology student for furthering in animal studies.	R, U	PO1, PO2, PO6, PO7 PSO1, PSO3, PSO4
Unit 2: Life Processes - I	**CO2:** Elucidate the interplay between structure and function in animal biology which has survival value. Facilitate clarity on the working of human machine through analysis of animal physiology (physiological processes – inner working of animals).	R, U	PO1, PO2 PSO1, PSO2

	Account for the bodily processes as movement and locomotion, nutrition, respiration and circulation.		
Unit 3: Ecology	**CO3:** Outline concepts of ecology – a study of where (place) and how (interaction) organisms live on earth, and realise that any imbalances in the delicate ecological networking of organisms could lead to problems of global environmental concern. Recognise that living things transform energy.	R, U	PO1, PO2, PO7 PSO1, PSO3, PSO4

Course Code: SIUSZO12
Course Name: Molecular basis of life - I, Biotechnology - I and Genetics
The study of this course will accomplish the following outcomes:

Unit	Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
Unit 1: Molecular basis of life - I	**CO1:** Account for the underlying chemistry that both makes possible and sustains life, by a discussion on biomolecules (here, focussing on proteins and carbohydrates). Apply this basic knowledge for advancing in varied fields of biological sciences having social relevance.	R, U	PO1, PO2, PO8 PSO1, PSO2, PSO3, PSO4
Unit 2: Biotechnology - I	**CO2:** Introduction to biotechnology – a field of endeavour and a frontier open for invention by application of technological advancements to biological systems for human benefit. Insight on some tools and techniques of biotechnology, and account for applications in food and enzyme technology.	R, U, Ap	PO2, PO7 PSO1, PSO2, PSO3, PSO4
Unit 3: Genetics	**CO3:** Build a conceptual framework of the science of inheritance – genetics, through discussion on mendelian inheritance, cytoplasmic inheritance and touching on human genetics. Acknowledge the lasting contribution of Gregor Mendel and his methodology demonstrating his scientific and perseverant traits.	R, U, Ap, An	PO1, PO2, PO8 PSO1, PSO2, PSO4

Semester II – Theory

Course Code: SIUSZO21
Course Name: Diversity of Animal Kingdom - II, Life Processes - II and Ethology
The study of this course will accomplish the following outcomes:

Unit	Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
Unit 1: Diversity of Animal Kingdom - II	**CO1:** Expand the understanding of diversity of animal life by an account of animals with more complex levels of organization (Mollusca to Chordata); an understanding that may aid a healthy man-animal coexistence.	R, U	PO1, PO2, PO6, PO7 PSO1, PSO3, PSO4

	Develop interest in specific animal groups for an uncharted exploration and specialization in them.		
Unit 2: Life Processes - II	**CO2:** Elucidate the interplay between structure and function in animal biology which has survival value. Facilitate clarity on the working of human machine through analysis of animal physiology (physiological processes – inner working of animals). Account for the bodily processes as excretion and osmoregulation, control and coordination, and reproduction.	R, U	PO1, PO2 PSO1, PSO2
Unit 3: Ethology	**CO3:** Understand "nature versus nurture" concept in development of animal behaviour, and an insight into the various experiments and original observations to explain animal learning. Deepen knowledge to apply for a career in zookeeping.	R, U	PO2, PO7 PSO1, PSO3, PSO4

Course Code: SIUSZO22
Course Name: Molecular basis of life - II, Biotechnology - II, and Evolution and Biodiversity
The study of this course will accomplish the following outcomes:

Unit	**Course Outcome (CO)**	**Cognitive Level**	**Affinity with PO/ PSO**
Unit 1: Molecular basis of life - II	**CO1:** Extend the account for the underlying chemistry that both makes possible and sustains life, by a discussion on biomolecules (here, focussing on lipids and nucleic acids). Apply this basic knowledge for advancing in varied fields of biological sciences having social relevance.	R, U	PO1, PO2, PO8 PSO1, PSO2
Unit 2: Biotechnology - II	**CO2:** Introduction to biotechnology – a field of endeavour and a frontier open for invention by application of technological advancements to biological systems for human benefit. Insight into transgenesis, animal cloning, gene therapy for benefit of mankind, and application for environmental concerns.	R, U, An	PO2, PO7 PSO1, PSO2, PSO3, PSO4
Unit 3: Evolution and Biodiversity	**CO3:** Introduction to evolution for understanding of events and processes that have shaped, reshaped the living world on planet earth. Insight into the wealth of living forms on earth for wise and sustainable usage of these natural resources for man's livelihood as well as recreational activity.	R, U, An	PO2, PO7 PSO1, PSO2, PSO3, PSO4

PRACTICAL

"*Study nature not books.*" – An old dictum.

The practical course in Zoology is designed for first hand study of animal life through observation of preserved specimens, *in situ* organ systems, microscopic examination of permanent slides, etc. as well as to perform experiments to strengthen the concept base.

It is an effort to invigorate a thought process that can analyse and reason for the sake of awareness, hence to reach a valid answer.

Semester I – Practical

Course Code: SIUSZOP11
Course Name: Practical I based on SIUSZO11

Course Outcome (CO)	Details	Cognitive Level	Affinity with PO/ PSO
	• Discuss levels of organization in animal kingdom on which animal body plans are made. • Elaborate on animal diversity (Protozoa to Arthropoda) and inquire into the relatedness of taxa in animal kingdom by direct observation preserved specimens/ permanent slides of chosen representatives from each phylum. • Explain essential life processes as digestion, excretion-osmoregulation and movement-locomotion by microscopic examination of one-celled animalcule, *Paramoecium.* • Account for functional morphology in animals by examining (preserved/ fresh, wherever applicable) nutritional apparatus, respiratory structures, hearts and blood smears of selected animals. • Emphasize the role of factors like pH and temperature for enzyme functioning by testing amylase activity, under physiology of digestion. • Examine a beating heart under light microscope and determine its rate by using crustacean arthropod *Daphnia*. • Explain coexistence and coevolution of animal forms through animal interaction study.	R, U, Ap, An, E	PO1, PO2, PO6, PO7 PSO1, PSO2, PSO3, PSO4

Course Code: SIUSZOP12
Course Name: Practical II based on SIUSZO12

Course Outcome (CO)	Details	Cognitive Level	Affinity with PO/ PSO
	• Analyze the importance of laboratory safety practices and safety symbols, for awareness regarding conduct as a science student. • Describe the handling and use/ function	R, U, Ap, An, E	PO1, PO2, PO3, PO5, PO6, PO8

	of basic laboratory equipments/ instruments in an undergraduate course laboratory. • Comprehend the significance of aseptic techniques in biological experiments. • Demonstrate/show chromatography as a separation technique in biology by performing paper chromatography. • Insight into the chemistry of biomolecules – proteins and carbohydrates by their qualitative detection. • Test the feasibility of immobilization technique in laboratory and discuss its applications in industry. • Explain fermentation, an age-old process known to mankind and meat tenderization, both with applications in food industry for consumer satisfaction. • Compare and discuss modes of inheritance of genetic traits in humans by solving problems based on pedigree analysis of humans.		PSO1, PSO2, PSO3, PSO4

Semester II – Practical

Course Code: SIUSZOP21
Course Name: Practical I based on SIUSZO21

Course Outcome (CO)	**Details**	**Cognitive Level**	**Affinity with PO/ PSO**
	• Identify, describe and classify animal representatives of different phyla (Mollusca to Chordata) as well as analyse the evolutionary connect between them. • Discuss vital life processes – digestion, excretion, nervous control and reproduction, through observation of structures/ organs in different animal specimens (preserved or fresh) and permanent slides, and clarify their possession by these animals. • Observe under light microscope the structure of an excretory organ – septal nephridium present in an invertebrate – earthworm, and compare and contrast it with nephron of mammalian kidney. • Describe irritability, a kind of response shown by the microscopic animalcule – *Paramoecium*, demonstrating sensitivity/ ability to sense the environment, a basic feature of life. • Explain behavioural ecology with examples of mimicry in the animal world.	R, U, Ap, An	PO1, PO2, PO7 PSO1, PSO2, PSO3, PSO4

Course Code: SIUSZOP22
Course Name: Practical II based on SIUSZO22

Course Outcome (CO)	Details	Cognitive Level	Affinity with PO/ PSO
	• Realise the ease of carrying out chromatography in college laboratory, a separation technique with wide applications; and explain the underlying principle of Thin layer chromatography (TLC) and adsorption chromatography. • Detect presence of lipids, one of the biomolecules, by their physical and chemical properties. Also perform extraction/ removal of another biomolecule – nucleic acids (DNA and RNA) and confirm their presence by specific chemical tests. • Describe the different methodologies for transgenesis; recognise the use of technological advancements on biological systems, and realise about the expertise and patience required to attain these transformations, for human welfare. • Differentiate between the two broad categories of bacteria using Gram staining, a method that can serve as preliminary diagnostic test for bacterial infection disease. • Discuss and perform a simple method to evaluate the quality of milk sample by checking its bacterial load, which has a direct impact on fitness of milk for human consumption and hence on commercial value of milk. Understand the International Organization for Standardization (ISO) criteria for milk quality. • Conclude the reality of evolution by explaining analogy, homology and by a mention of fossils (invertebrate fauna fossils).	R, U, Ap, An, E	PO1, PO2, PO5, PO6, PO7, PO8 PSO1, PSO2, PSO3, PSO4

Course Outcomes for SYBSc

At the root of all (science) education (Core Learning Outcome):
"The imaginative and original mind need not be overawed by the imposing body of present knowledge or by the complex and costly paraphernalia which today surround much of scientific activity. The great shortage in science now is not opportunity, manpower, money, or laboratory space. What is really needed is more of that healthy skepticism which generates the key idea – the liberating concept." *– P.H. Abelson*
Purity of mind leads to clarity in thought and action for creation of an original archaic work.
As well, to consciously attempt the basic pursuit of understanding human existence.

Semester III – Theory

Course Code: SIUSZO31
Course Name: Invertebrate life, Developmental Biology, Evolution
The study of this course will accomplish the following outcomes:

Unit	Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
Unit 1: Wonders of Animal Kingdom – Invertebrate Life	**CO1:** Recognise and describe the innovations in form and function of invertebrate life and relate their possession to the capability of these living forms to explore and adapt to varied habits and habitats. Understand the significance of these animals to mankind, both useful and harmful. • Describe skeletal types developed for protection; types of reproduction to form their own kind and the phenomenon of bioluminescence in the most primitive life forms – the unicellular Protozoa. • Describe canal systems of varying complexity; types of spicules as part of endoskeleton and as criterion for classifying; reproduction and capacity for regeneration in less specialised animal forms – the multi-celled Porifera. • Discuss existence of polymorphism representing division of labour and evolutionary significance; and types and theories of formation of coral reefs considered as highly productive areas of ocean, in the tissue level of organization – the Coelenterata. • State the characteristics of acoelomate Platyhelminthes and pseudocoelomate Nemathelminthes making them successful parasites. • Attribute metamerism to the very existence of Annelida and discuss reproduction in this coelomate phylum. • Analyse the survival value in possessing larval stages and showing the phenomenon of metamorphosis in the jointed limbs – the	R, U, An	PO2, PO7, PO8 PSO1, PSO2, PSO3

	Arthropoda. • Explain shell coiling and torsion as an adaptation to balance the 'belly-footed' shelled body, a representative of the Mollusca. • Comprehend the design of hydraulic system – water vascular system, and discuss different larval stages in the spiny-skinned Echinodermata.		
Unit 2: Developmental Biology	**CO2:** Explore the ground plan of animal development at the molecular, cellular, genetic and evolutionary levels. Reflect upon the implications of developmental biology in experimental biology (research) and for human welfare. • Know *Dictyostelium*, an accessible organism for studies of signaling via chemoattractant receptors. • Discuss the process of fertilization and the phenomenon of parthenogenesis in animals. • Classify different types of eggs, cleavage patterns and blastula in various animal groups. • Define gastrulation, understand its mechanism in forming germ layers and setting the embryo up for organ formation.	U, An	PO2, PO7 PSO1, PSO2 PSO4
Unit 3: Origin of Life and Evolution	**CO3:** Conceptualize the beginning of universe and the origin of life and its progression by experimental evidence for chemical evolution and theories of organic evolution. Insight into the process of evolution and its mechanisms that have shaped the biosphere.	R, An	PO2, PO7 PSO1, PSO2, PSO4

Course Code: SIUSZO32
Course Name: Biochemistry and Genetics
The study of this course will accomplish the following outcomes:

Unit	**Course Outcome (CO)**	**Cognitive Level**	**Affinity with PO/ PSO**
Unit 1: Molecules and Life	**CO1:** Agree that water molecule forms the basis for sustenance of life on earth through insight into its molecular structure, chemical and physical properties. Explain acids, bases, pH and buffers; apply Henderson-Hasselbalch equation for calculating pH; plot titration curves and comprehend the role of buffers in biological systems.	U, Ap, An	PO1, PO2 PSO1, PSO2
Unit 2: Metabolism and Energy	**CO2:** Examine bioenergetics to become aware of the energy exchanges occurring in living organisms and analyse metabolism – the marvelously engineered network of enzymatic reactions, that transforms nutrients to sustain	U, An	PO2, PO8 PSO1, PSO2

	life. Discuss thermodynamics to know how fundamental laws of physical science govern living organisms. Ground in the fundamentals of carbohydrate, protein and lipid metabolism which have application in biochemical research and medicine.		
Unit 3: Genetics	**CO3:** Further probe into classical genetics – an area of genetics focusing on mechanisms of inheritance in organisms responsible for resemblances and variations, and that are central to diversity of life on earth. Realise the implications for developing treatment for a trait – genetic disorder in humans, and for improving traits – yield, resistance to disease, etc. in domesticated animals/ livestock by understanding behaviour of gene in chromosome and its functional state.	U, An	PO2, PO8 PSO1, PSO2

Course Code: SIUSZO33
Course Name: Parasitology, Entomology and Economic Zoology
The study of this course will accomplish the following outcomes:

Unit	**Course Outcome (CO)**	**Cognitive Level**	**Affinity with PO/ PSO**
Unit 1: Introduction to Parasitology and Protozoan parasites	**CO1:** Acquaint with parasitology – an interdisciplinary field of science embracing zoology, microbiology, immunology, etc. and concerned with basic biology and clinical aspects of parasites, organisms that impact human health. In-depth coverage of few protozoan parasites of human concern. Become aware about the potential for pursuing training in diagnostic parasitology in health care laboratories with this basic knowledge. Realise importance of hygiene standards in disease prevention.	U, An	PO1, PO2, PO8 PSO1
Unit 2: Economic Entomology	**CO2:** Understand entomology – the science of insects (kind of arthropods) from commercial viewpoint by discussing general biology/ life histories of selected insect species, both useful and harmful to human interest. Encourage the entrepreneur in students of zoology.	U, An	PO1, PO8 PSO1, PSO3
Unit 3: Animal Husbandry – Vermiculture, Poultry, Goat farming	**CO3:** Uncover animal husbandry – a branch of agricultural science by an extensive discussion on vermiculture (dealing with earthworm, an invertebrate), poultry (involving feathered vertebrates) and goat farming (involving a mammal). Acknowledge the existence and characteristics of these farm animals making them entities from which to procure products of human utility. Provoke raw enthusiasm of the zoology student for business.	U, An	PO1, PO8 PSO1, PSO3

	Hope for scope as research worker in agricultural research or to obtain basic training in raising farm animals for a future/ livelihood.		

Semester IV – Theory

Course Code: SIUSZO41
Course Name: Chordate life, Cell biology and Scientific research
The study of this course will accomplish the following outcomes:

Unit	Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
Unit 1: Wonders of Animal Kingdom – Chordate life	**CO1:** Describe the novel features developed in chordates that enabled them to explore and adapt to new ecological opportunities. Establish kinship relationship among the different taxa in Chordata. Encourage active exploration of the animal kingdom.	R, U	PO2, PO7 PSO1, PSO2
Unit 2: Cellular Organization	**CO2:** Justify that cell is indeed the basic structural and functional unit of life by a thorough discussion on the structural constituents (plasma membrane and cell organelles) of cell and their functions. Gain clearer understanding of form and function interrelation at the organizational level of cell other than at organismal level. Critical thinking over the advances in tools for biological studies that have made possible this detailing of the cellular organization otherwise unknown to the naked eye.	U, E	PO2 PSO1, PSO2
Unit 3: Basic Concepts in Research	**CO3:** Establish thorough grounding in the art of scientific method which inquires the dynamic nature of science by a precise, honest, disciplined and mindful approach. Illumine investigative side of student inquirer for manifestation of his/her intellectual calling that could be a matter of wide public interest.	An, C	PO1, PO2, PO3, PO7, PO8 PSO1, PSO2, PSO4

Course Code: SIUSZO42
Course Name: Molecular biology, Biotechnology and Bioinformatics
The study of this course will accomplish the following outcomes:

Unit	Course Outcome (CO)	Cognitive Level	Affinity with PO/ PSO
Unit 1: Molecular Biology	**CO1:** Acknowledge the ground-breaking discovery of the molecular structure of genetic material that laid the foundation for understanding 'central dogma of molecular biology – the processing of genetic information – forming 20-letter alphabet of protein structure from nucleotide symbols of genetic material'.	U, An	PO2, PO8 PSO1, PSO2, PSO4

	Emphasize the unifying nature of genetic program in living organisms.		
Unit 2: Biotechnology	**CO2:** Elaborate on recombinant DNA technology/ genetic engineering – the principal aspect of biotechnology which allows laboratory construction of new DNA molecules that may not occur biologically. Consider biotechnology as an avenue for genetic research with its spectacular achievements/ applications having social implications.	U, An	PO2, PO7 PSO1, PSO2, PSO4
Unit 3: Bioinformatics	**CO3:** Gain substantial background of a revolutionising field of science – bioinformatics, that studies an organism's genome using computational tools, and holds application in medicine (studying genetic disorders) and studying phylogeny amongst others. Uncover the Human Genome Project and realise its potential in bettering human society.	U, An	PO1, PO2, PO4, PO8 PSO1, PSO2, PSO4

Course Code: SIUSZO43
Course Name: Parasitology, Fisheries and Economic Zoology
The study of this course will accomplish the following outcomes:

Unit	**Course Outcome (CO)**	**Cognitive Level**	**Affinity with PO/ PSO**
Unit 1: Helminth Parasitology	**CO1:** Further into parasitology by an extensive discussion on helminth (multicellular animals with long, thin bodies) parasites with complex life cycles and an extraordinary array of adaptations ensuring their survival in a wide range of hosts. Penetrating insight into the debilitating effects of these lower forms of life that can sweep the so-called superior human race of its well-being; hence also create awareness in general public of such pathogens.	R, U, An	PO1, PO2, PO6, PO8 PSO1, PSO2
Unit 2: Fishery Science	**CO2:** Account for a branch of applied zoology – fishery science dealing with fish and other aquatic invertebrates that hold interest of mankind as a source of nourishment and a resource for commerce. Comprehensive information of biology, methods of procuring and culturing, processing and marketing of selected few species of Indian fish, molluscs and crustaceans. Motivate to be self-starter or personnel in fishery industry by acquiring further knowledge and skills.	R, U	PO6, PO7, PSO1
Unit 3: Animal Husbandry – Sheep farming, Cattle farming, Dairy Science	**CO3:** Expand the account on animal farming by detailing in sheep, cow and buffalo farming, as well as dairy science. Delve in the animal wealth of India for an investment in this area as future progressive farmers.	U, An	PO1, PO2, PO6, PO7 PSO1, PSO2

PRACTICAL

"*Study nature not books.*" – An old dictum.
The practical course in Zoology is designed for first hand study of animal life through observation of preserved specimens, *in situ* organ systems, microscopic examination of permanent slides, etc. as well as to perform experiments to strengthen the concept base.
It is an effort to invigorate a thought process that can analyse and reason for the sake of awareness, hence to reach a valid answer.

Semester III – Practical

Course Code: SIUSZOP31
Course Name: Practical I based on SIUSZO31

Course Outcome (CO)	Details	Cognitive Level	Affinity with PO/ PSO
	• Identify and describe various specimens, permanent microscope slides with respect to specific characteristic features in invertebrate animal kingdom. • Discuss crustacean and echinoderm larvae, and insect metamorphosis. • Describe types of egg and early embryonic stages of chosen animal species. • Identify, compare, and discuss the types of speciation - a process in evolution of life forms.	U, An	PO2, PO7, PO8 PSO1, PSO3

Course Code: SIUSZOP32
Course Name: Practical II based on SIUSZO32

Course Outcome (CO)	Details	Cognitive Level	Affinity with PO/ PSO
	• State the principle and explain the working of pH meter, an instrument to measure pH – a parameter with implications on functioning of biological system. Use pH meter for plotting titration curve and determining pKa. • Calculate pH using Henderson-Hasselbalch equation and apply this for preparation of buffer solutions with different pH. • State the principle and explain the working of colorimeter – a light sensitive instrument used for measuring concentration of coloured solutions, in biochemical assays, etc.; perform selection of best filter for a coloured solution in question. • Use glucometer and glucose estimation kit for estimating blood glucose level.	U, Ap, An, E	PO1, PO2, PO8 PSO1, PSO2, PSO3, PSO4

Course Code: SIUSZOP33
Course Name: Practical III based on SIUSZO33

Course Outcome (CO)	Details	Cognitive Level	Affinity with PO/ PSO
	• Identify, describe, and comment on pathogenesis of selected protozoan parasites by observing permanent slides/ blood smears. • Identify and discuss the life histories of some beneficial and harmful insects to understand their purpose for mankind; perform structure-function analysis of insect body by preparing mountings of honey bee mouth parts, legs and sting apparatus. • Identify and describe breeds of fowl and goat through pictures, applicable for selection of a breed to suit the purpose. • Use colorimeter to estimate protein and total lipid content of two egg varieties (hen's egg) and know about any difference in the content, and about factors that may influence it; understand the principle of Biuret/ Folin-Lowry method and ferric chloride method.	U, An, E, C	PO2, PO7, PO8 PSO1, PSO2, PSO3, PSO4

Semester IV – Practical

Course Code: SIUSZOP41
Course Name: Practical I based on SIUSZO41

Course Outcome (CO)	Details	Cognitive Level	Affinity with PO/ PSO
	• Explain functional morphology in the animal world by identifying and describing different museum specimens of chordates/ vertebrates. • Apply the knowledge of osmosis to study features of plasma membrane (cell boundary); describe the structure and function of cell organelles through observing their electron micrographs. • Understand chromosomes by performing and observing (under light microscope) squash preparation of onion root tip and temporary preparation of polytene chromosomes of Chironomus larva. • Understand the ways of scientific research by study of bibliography, preparing an abstract and power point presentation for scientific research paper – for initiating into the scientific research world.	U, Ap, E, C	PO1, PO2, PO3, PO4, PO5, PO7, PO8 PSO1, PSO2, PSO3, PSO4

Course Code: SIUSZOP42
Course Name: Practical II based on SIUSZO42

Course Outcome (CO)	Details	Cognitive Level	Affinity with PO/ PSO
	• Apply the basic understanding of molecular biology and biotechnology for problem solving. • Analyse the importance of information technology in understanding biology through bioinformatics.	Ap, An, E, C	PO1, PO2, PO4, PO8 PSO1, PSO2, PSO4

Course Code: SIUSZOP43
Course Name: Practical III based on SIUSZO43

Course Outcome (CO)	Details	Cognitive Level	Affinity with PO/ PSO
	• Identify, describe, and analyse the pathology of helminth parasites of the animal world by observing museum specimens and permanent slides. • Identify and discuss aspects of fish (chosen specimens – preserved/ fresh) such as morphological characters, fishery; knowledge about the tools (crafts and gears) in fishery by observing models/ photographs. • Understand the science of animal husbandry by identifying and observing photographs of selected breeds of cattle, buffalo and sheep; perform assessment of milk quality by checking for milk adulterants and density measurement by a tiny, simple glass device – lactometer. • Create a field visit report based on the field visit undertaken for direct experience and observation of the natural world of animals.	U, Ap, An, E, C	PO1, PO2, PO5, PO6, PO7, PO8 PSO1, PSO2, PSO3, PSO4

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