M. G. Science Institute, Ahmedabad

Autonomous | Affiliated to Gujarat University, Ahmedabad

(Managed by The Ahmedabad Education Society)

Department of Biological Science

Integrated Mater of Science in Biological Science

(Effective from Academic Year 2026-27)

Content

1.0 Preamble

Welcome to the Integrated Master of Science (M.S) in Biological Science program, a fundamental field at the core of scientific innovation and technological advancement. This program is designed to provide students with a comprehensive understanding of the principles, applications, and ethical considerations of Botany, Zoology, Microbiology and Biochemistry, preparing them for dynamic careers in research, industry, healthcare, and beyond.

2.0 Definitions

Integrated Master of Science (M.S)

Integrated Master of Science (M.S) aims at providing advanced and specialized theoretical and research skills in the chosen science subject, along with the overall knowledge in the sciences, to provide the students a strong platform for an advanced academic or professional career.

Choice Based Credit System

The Choice Based Credit System (CBCS) provides an opportunity for the students to choose courses from the prescribed courses comprising Core, minor, multi-disciplinary, or skill-based courses.

Credit

Credits means the value assigned to a course which indicates the level of instruction:

1 hour lecture per week equals 1 credit

2 hours practical per week equals 1 credit

Credit for a practical could be proposed as part of a course or as a separate practical course.

SGP
A

SGPA means Semester Grade Point Average calculated for individual semesters.

CGPA

CGPA means Cumulative Grade Point Average calculated for all courses completed by the students at any point of time. CGPA is calculated for each year for both semesters clubbed together.

Course

A course is a specific subject in the academic program taught in a particular semester for the specifically assigned number of credits.

Course Announcement

The college shall announce the elective courses it proposes to offer to the students out of the wider course basket. It is not mandatory to offer all the electives. The decision of the principal shall be final in this case. However, in the spirit of Choice Based Credit System, the college should offer choices to the students for the elective courses and not offer only the minimum number of electives.

Course Registration

It is mandatory for every student, to register every semester, for the elective courses opted for that semester. Each student, on admission shall be assigned to a Faculty Advisor who shall advise him/her about the academic programs and counsel on the choice of courses considering the student's profile, career goals and courses taken in the earlier semesters. With the advice and consent of the Faculty Advisor, the student shall register for a set of courses he/she plans to take up for the Semester. Students shall have to register for the courses for the semester within first week of

Semester I and immediately adhere conclusion of the preceding term for subsequent Semesters II, III, IV, V, VI, VII, VIII, IX and X.

Course Outcomes

Course outcomes are the specific and measurable attributes defining the knowledge, skill and attitude of the learners are expected to demonstrate by the completion of the course.

Grading System

The Grading System is the 10-point standard scale system defined by the UGC comprising of the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA).

Grade	Grade
O (Outstanding)	10
A+ (Excellent)	9
A (Very Good)	8
B+ (Good)	7
B (Above	6
C (Average)	5
P (Pass)	4
F (Fail)	0
Ab (Absent)	0

Graduate Attributes

The Graduate attributes are the generic abilities, attitudes and approaches expected to be demonstrated by the learner in the world around him/her in a longer period of the life time.

Learning Outcomes

Learning outcomes describe the measurable skills, abilities, knowledge, or values that students should be able to demonstrate as a result of completing a course.

Outcome Based Education (OBE) Approach

OBE is the approach focusing on the performance outcome comprising of the following:

a. The performer – the student (learner), not only the teacher.
b. The performable (thus demonstrable or assessable) to perform
c. The performance outcome, not the activity or task to be performed.

Outcome-Based Assessment

An assessment system that asks course teachers to first identify what it is that we expect students to be able to do once they have completed a course or program. It then asks course teachers to provide evidence that they are able to do so. In other words, how will each learning outcome be assessed? What evidence of student learning is most relevant for each learning outcome and what standard or criteria will be used to evaluate that evidence Assessment is therefore a key part of outcome-based education and used to determine whether or not a qualification has been achieved.

Program Educational Objectives

Program Educational Objectives are a set of broad future-focused student performance outcomes that explicitly identify what students will be able to do with what they have learned, and what they will be like there they leave school and are living full and productive lives. Thus, PEOs are what the program is preparing graduates for in their career and professional life to attain within a few years of graduation.

Program Outcomes

Program Outcomes are a set of narrow statements that describe what learners of the program are expected to know and be able to perform or attain by the time of post-graduation.

Program Specific Outcomes

The PSOs are a set of narrow statements that describe what the learners of a specific specialization of the program are expected to know and be able to perform or attain by the time of post-graduation. PSOs are also a function of the various course combinations offered by the college.

Semester

The Semester means the one half of the academic year comprising of the teaching days and examination & evaluation days as per the UGC/ University norms.

Teaching and Learning Activities

The set of pedagogical tools and techniques or the teaching and learning activities that aim to help students to attain the intended learning outcomes and engage them in these learning activities through the teaching process.

3.0 Integrated M.S. In Biological Science Program Focus

Programme outcomes (POs)

a) The Integrated M.S in Biological Sciences program offers a rigorous curriculum that integrates foundational knowledge in botany, zoology, biochemistry, microbiology, chemistry, and statistics.

b) Students will explore the diverse applications of Biological Sciences, relevant to industries in nutraceutical, agriculture, pharmaceutical, and different laboratories.

c) Through hands-on laboratory experiences, research projects, and industry internships, students will develop practical skills and critical thinking abilities essential for success in the field.

Graduate Attributes (GAs)

These attributes reflect the core competencies necessary for graduates to succeed in the field. The common graduate attributes for Integrated M.S in Biological Sciences courses are:

Technical Competence:
Proficiency in botany, zoology, microbiology, chemistry and statistics. Skilled in laboratory techniques relevant to industries and market needs pertaining to core subjects of botany, zoology, microbiology, chemistry and statistics.

Critical Thinking and Problem Solving:
Analytical skills to address complex biological problems. Ability to evaluate scientific literature and propose innovative solutions.

Ethical Awareness:
Understanding of ethical implications in biotechnological research and applications. Commitment to responsible conduct in research and adherence to ethical principles.

Communication Skills:
Clear and persuasive communication of scientific findings to diverse audiences. Ability to engage in constructive dialogue on biotechnological issues.

Teamwork and Collaboration:
Collaborative skills to work effectively in multidisciplinary teams. Leadership abilities and contribution to group projects.

Professionalism:
Demonstration of professionalism, integrity, and adherence to ethical guidelines. Commitment to lifelong learning and staying updated with advancements in biology.

Entrepreneurial Skills:

Understanding of business aspects including intellectual property rights and commercialization strategies. Ability to identify market opportunities and develop business plans.

Global Awareness:

Awareness of the global impact of biology on society, environment, and health. Engagement in cross-cultural dialogue and collaboration.

4.0 Integrated M.S. In Biological Science Programme Course Types and Evaluation Pattern

Sr. No.	Course Type	Credits	Nature	CCE Marks	ECE Marks	Total Marks
1	Major Course	4	Compulsory	50	50	100
2	Minor Course	4	Compulsory	50	50	100
3	Multidisciplinary Course	4	Elective	50	50	100
4	Skill Enhancement Course	2	Elective	25	25	50
5	Ability Enhancement Course	2	Elective	25	25	50
6	Indian Knowledge System/ Value Added Courses	2	Elective	25	25	50

Courses Types Definitions:

1. **Major Course (BS-M)**

Discipline-specific course core is a course that a student admitted to a particular programme must successfully completed receiving the degree and which cannot be substituted by any other course.

2. **Minor Course (BS-E)**

A discipline specific Minor Course refers to a set of academic courses that form a focused and specialized area of study within a particular discipline. Students have the option to pursue a minor alongside their major allowing them to gain additional experience in a specific subject.

3. **Multidisciplinary Course (MDC)**

A multidisciplinary course is a course chosen generally from a related discipline/subject, intending to seek exposure in the discipline relating to the core domain of the student.

4. **Skill Enhancement Course (BS-SEC)**

Skill Enhancement Course is designed to provide students with specific skills or knowledge in addition to their primary academic pursuits. The main purpose of the SEC is to provide students with practical skills, life skills, soft skills, hands-on training, etc. to increase their employability.

5. **Ability Enhancement Course (AEC)**

The ability enhancement course is designed to improve students' communication, language, and personality development skills. The main purpose of the AEC is to introduce students to the theory, fundamentals, and tools of communication and to develop in them vital communication skills that should be integral to personal, social, and professional interactions.

6. **Indian Knowledge System (IKS)**

Indian Knowledge System refers to the rich and diverse heritage of knowledge, wisdom, and traditions that have evolved over millennia within the Indian subcontinent.

5.0 Integrated M.S. Programme Structure

Integrated M.S. in Biological Science is a five-year programme divided into ten semesters. A student is required to complete 176 credits for the completion of the programme and the award of Integrated M.S in Biological Science degree. The Integrated M.S. in Biological Science programme is aligned with the NEP-2020 structure as given in below Table.

Course	No. of	Credits	Total
BS-Major	24	4	96
BS-Minor	8	4	32
MDC	3	4	12
AEC	5	2	10
SEC	5	2	10
IKS/VAC **OJT/RP**	4 2	2 6	8 12
Dissertation	2	20	40
		Total	**220**

Details of Programme

Year	Semester	Course Type (Credits)				
1st Year	Sem-I	**Major-1**	**Major-2**	**Minor-1**	**MDC-1**	**AEC-1**
		SEC-1	**IKS-1**			
		(4)	**(4)**	**(4)**	**(4)**	**(2)**
		(2)	**(2)**			
	Sem-II	**Major-3**	**Major-4**	**Minor-2**	**MDC-2**	**AEC-2**
		SEC-2	**VAC-1**			
		(4)	**(4)**	**(4)**	**(4)**	**(2)**
		(2)	**(2)**			
2nd Year	Sem-III	**Major-5**	**Major-6**	**Major-7**	**MDC-3 (4)**	**AEC-3**
		SEC-3	**IKS-2**			
		(4)	**(4)**	**(4)**		**(2)**
		(2)	**(2)**			
	Sem-IV	**Major-8**	**Major-9**	**Major-10 (4)**	**Minor-3 (4)**	**AEC-4**
		SEC-4	**VAC-2**			
		(4)	**(4)**			**(2)**
		(2)	**(2)**			
3rd Year	Sem-V	**Major-11 (4)**	**Major-12 (4)**	**Major-13 (4)**	**Minor-4 (4)**	**Minor-5**
		SEC-5	**-**			
		(2)				**(4)**
	Sem-VI	**Major-14 (4)**	**Major-15 (4)**	**Major-16 (4)**	**Minor-6 (4)**	**AEC-5 (2)**
		Internship	**-**			
						(4)
4th Year	Sem-VII	**Major-17 (4)**	**Major-18 (4)**	**Major-19 (4)**	**Minor-7 (4)**	**-**
		OJT/RP-1 (6)	**-**			
	Sem-VIII	**Major-20 (4)**	**Major-21 (4)**	**Major-22 (4)**	**Minor-8 (4)**	**-**
		OJT/RP-2 (6)	**-**			
5th Year	Sem IX	**Dissertation-1 (20)**	**Major-23 (4)**			
	Sem X	**Dissertation-2 (20)**	**Major-24 (4)**			

6.0 Multiple Entry-Exit Option

The Integrated M.S. in Biological Science programme is fully compliant with the Curriculum and Credit Framework for Postgraduate Programmes issued by the UGC. Accordingly, the programme provides the exit option to the learners at the end of the first year with UG Certificate awarded, at the end of the second year with UG Diploma awarded, at the end of the third year with UG Degree awarded, at the end of the fourth year with UG Honors Degree awarded and at the end of five year with integrated post graduate degree. The learners choosing to exit the programme at the end of the first year or at the end of the second year will be allowed to, subject to successful completion of the relevant portion of the curriculum, shall be allowed to re-enter within a period of three years and complete the degree programme within a period of maximum seven years from the year of the first admission. All the other details are as provided in Sec.3.2.3 of the Curriculum and Credit Framework issued by the UGC in December 2022.

7.0 Internship Project

Every learner must undergo and complete the internships/apprenticeships in a firm/industry/organization or training in labs with faculty or researchers in their own or other college/institute/research institute on during the summer term. Completion of the Summer Internship shall be mandatory for every learner choosing to exit at the end of the first year with a UG Certificate or at the end of the second year with a UG Diploma. The Internship Project shall carry the weightage of 4 credits. Since the internship is categorized as Practice, every learner will have to actually produce the work for 120 hours during the internship.

Evaluation of the Internship Project:

It is mandatory for the student to seek advance written approval from the faculty guide and the HOD for the internship and organization before commencing the internship.

a. It is mandatory for the student to seek advance written approval from the faculty guide and the Director of the Institute about the topic and organization before commencing the Internship.

b. Students shall also seek a formal evaluation of their Internship Project from the external guide. The formal evaluation by the external guide shall be done for 50 marks and comment on the nature and quantum of work undertaken by the student, the effectiveness and overall professionalism. The learning outcomes of the Internship Project and utility of the project to the host organization must be specifically highlighted in the formal evaluation by the external guide. The Internship Project evaluation sheet duly signed and stamped by the external guide shall be included in the final Internship report.

c. The completion of the internship shall be certified by the respective Faculty Guide & approved by the Director of the Institute.

d. The college level evaluation shall be for 50 marks through the Viva-Voce conducted by the faculty guide and HOD of the respective department.

e. Copies of internship report and records of evaluation shall be maintained by the college for a period of 5 academic years.

8.0 Comprehensive Internal Evaluation (CIE)/Comprehensive Concurrent Evaluation (CCE)

1. The course teacher shall prepare the scheme of Comprehensive Concurrent Evaluation (Formative Assessment) before commencement of the term. The scheme of Comprehensive Concurrent Evaluation shall explicitly state the linkages of each CCE with the Course Outcomes and define the targeted attainment levels for each CO.

2. The Head of the Department shall approve the scheme of Comprehensive Concurrent Evaluation with or without modifications.
3. The course teacher shall display, on the notice board/ ERP, the approved CCE scheme of the course and the same shall also be hosted on the website, not later than the first week of the term.
4. Each CCE item shall be of minimum 25 marks.
5. For a 4 Credit Course there shall be a MINIMUM of three CCE items. The final scores shall be converted to 50, using an average or best two out of three formulae.
6. For 2 Credit Course there shall be a MINIMUM of two CCE items. The final scores shall be converted to 50.
7. CCE shall be spread through the duration of course and shall be conceptualized, executed, assessed and documented by the course teacher along with student-wise and class-wise attainment levels of the COs and the attainment levels of the course.
8. The assessment outcome of each CCE shall be duly signed by the course teacher & the programme coordinator / HOD of the college.
9. A copy of the duly signed CCE outcome shall be displayed on the notice boards/ ERP, within a week of the assessment and course teachers shall guide the students on a need basis.
10. The college may conduct additional make up / remedial CCE items at its discretion.
11. At the end of the term aggregate CCE scores/grades shall be calculated and the CO attainment levels shall be calculated by the course teacher. The same shall be displayed on the notice board/ ERP.
12. Records of CCE shall be retained for 5 years from the completion of the Academic Year. i.e. Current Academic Year (CAY) + 4 years.

The comprehensive internal evaluation shall be conducted by the college once a semester. The maximum marks for 4 credit courses shall be 50 and for 2 credit courses shall be 25 marks.

9.0 End-Semester Evaluation

1. The End Semester Evaluation (Summative Evaluation) for all the courses shall be conducted by the Examination Department/Committee of the college headed by a full- time regular faculty member nominated by the Principal as Controller of the Examination.
2. The ESE for each course shall have the weightage as follows:
   - For a 4 Credit Course: 50 marks
   - For a 2 Credit Course: 25 marks
3. The ESE for each course shall have 5 questions each of 10 marks. In case of 2 Credit courses the aggregate marks out of 50 shall be converted to the level proportionate to 25 marks.
4. All questions shall be compulsory with internal choice within the questions.
5. The broad structure of the ESE question paper shall be as follows:

Question Number	COGNITIVE ABILITIES	Nature
Q.1	REMEMBERING	Answer any 5 out of 8 (2 marks
Q.2	UNDERSTANDING	Answer any 2 out of 3 (5 marks
Q.3	APPLYING	Answer 3 (a) or 3 (b) (10 marks)
Q.4	ANALYSING	Answer 4 (a) or 4 (b) (10 marks)
Q.5	EVALUATING	Answer 5 (a) or 5 (b) (10 marks)
	CREATING	

10.0 Passing Standard

A learner shall be said to have earned the credits for a course if he/she earns minimum 36% marks. Formative Evaluation and Summative Evaluation shall be separate head of passing.

Grading System

The Indirect and Absolute Grading System shall be used, i.e., the assessment of individual Courses in the
concerned examinations will be on the basis of marks. However, the marks shall later be converted into
Grades by a defined mechanism wherein the overall performance of the learners can be reflected by considering the Credit Points for any given course. The overall evaluation shall be designated in terms of Grade. The 10-point standard scale mandated by UGC shall be used.
The performance of a student will be evaluated in terms of two indices,
viz.

(a) Semester Grade Point Average (SGPA) which is the Grade Point Average for a semester
(b) Cumulative Grade Point Average (CGPA) which is the Grade Point Average for all the completed semesters at any point in same Grade Point (Gi) (10 points scale) = Marks of each paper out of 100 / 10

Marks out of 100	Grade Point Range (Gi)	Grade	
96.0-100	10	O	Outstanding
86.0-95.9	9	A+	Excellent
76.0-85.9	8	A	Very Good
66.0-75.9	7	B+	Good
56.0-65.9	6	B	Above
46.0-55.9	5	C	Average
36.0-45.9	4	P	Pass
Below 36.0	0	F	Fail
Absent	0	Ab	Absent

The Semester Grade Point Average (SGPA) is the ratio of the sum of the product of the number of credits with the grade point scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$SGPA\ (Si) = \Sigma\ (Ci \times Gi) / \Sigma\ Ci$$

where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course.

The cumulative grade point average (CGPA) is also calculated in the same manner taking into all the courses undergone by a student over all the semesters of a programme, i.e.,

$$CGPA = \Sigma\ (Ci \times Si) / \Sigma\ Ci$$

where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that i^{th} semester. The SGPA and CGPA shall be rounded off to 2 decimal points.

Scaling Down of the CIE Score

The marks obtained by the student for the CCE shall be scaled down, to the required extent, if percentage of the marks of CCE exceeds the percentage of marks scored in the ESE (End Semester University Examination) by 25% for the respective course.

Degree Requirements

The degree requirements for the Integrated M.S. in Biological Sciences programme are completion of minimum 136 credits and 180 credits in case of Honours degree.

Maximum Duration for Completion of the Programme

The program of the study is four years of eight semesters. A candidate shall complete his/her degree within **seven (7)** academic years from the date of his/her admission to the first semester.

Grade Improvement

There shall be a provision for candidates to reappear for the examination for the concerned course of theory papers only (subject) in which the candidate wishes for improvement of his/ her grade point of SGPA in general and CGPA in a total of the program subject to the condition that:

a) The candidate shall be eligible to reappear for improvement of grade points only after successfully passing the program.
b) The candidate may opt for the examination for any number of courses (subject/paper) of the programme for improvement of grade points but not more than three times for each course (subject/paper) as per the prevailing syllabus of the examination conducted in the regular schedule of University examinations.
c) All such provisions are there within 04 years from successful completion of the programme, but not exceeding the period of 08 years of the duration of completion of the programme.
d) In all such cases grade points are considered if there is a progress in such improvements, otherwise, original grade points shall be retained.
e) No such candidates shall be eligible for the award of Rank, Gold Medal, Cash Prize, etc.
f) The validity of credits earned will be for a maximum period of seven years or as specified by the Academic Bank of Credits (ABC).

11.0 Attendance

The student must meet the requirement of 75% attendance per semester per course for grant of the term. The college may condone the shortage in attendance in exceptional circumstances, up to a maximum of 10%. The college shall have the right to withhold the student from appearing for examination of a specific course if the above requirement is not fulfilled.

12.0 Medium of Instruction

The medium of instruction and evaluation shall be English.

13.0 Detailed Course List (Annexure-1)

Detailed course list is available in Annexure-1

14.0 Detailed Syllabus for Each Course (Annexure-2)

Detailed syllabus for each course is available in Annexure-2

Detailed Course List for Integrated M.S. Biological Sciences up to Sem IV

Year	Sem	Course Type	Course Code	Course Title	Credits T	Credits P	Total
1	Sem-I	BS-Core	BSM-111	Introduction to Bioscience I	4	0	4
		BS-Core	BSM-112	Practical	0	4	4
		BS-M	BSE-113	Foundations of Biostatistics	2	2	4
		IDC/Mul	CHMDC-114	Chemical Bases of Life	2	2	4
		AEC	AEC-115	Language through Literature I	2	-	2
		SEC	SEC-116	Aquaculture and Hydroponics	1	1	2
		VAC/IKS	IKS-117	Indian Knowledge System	2	-	2
	Sem-II	BS-Core	BSM-121	Introduction to Bioscience II	4	0	4
		BS-Core	BSM-122	Practical	0	4	4
		BS-M	BSE-123	Statistical Inference & Hypothesis Testing	2	2	4
		IDC/Mul	CH-124	Industrial Chemistry	2	2	4
		AEC	AEC-125	Language through Literature II	2	-	2
		SEC	SEC-126	Agro tourism and Wildlife tourism	1	1	2
		VAC/IKS	IKS-127	Introduction to Science and Technology	2	-	2
2	Sem – III	BS-Core	BSM-231	Fundamentals of Molecular Biology and Biochemistry	4	0	4
		BS-Core	BSM-231	Fundamentals of Botany and Zoology	4	0	4
		BS-Core	BSM-232	Practical	0	4	4
		IDC/Mul	CHMDC-234	Applied Industrial Chemistry	2	2	4
		AEC	AEC-235	English for Excellence I	2	-	2
		SEC	SEC-236	Composting, Rainwater harvesting	1	1	2
		VAC/IKS	IKS-237	Indian Knowledge System	2	-	2
	Sem IV	BS-Core	BSM-241	Genetic Engineering (Tools and Technique)	4	0	4
		BS-Core	BSM-241	Tissue Culture	4	0	4
		BS-Core	BSM-242	Practical	0	4	4
		BS-M	BSE-243	Regression, Correlation & Experimental Design	2	2	4
		AEC	AEC-245	English for Excellence II	2	-	2
		SEC	SEC-246	Biosensors and Bioelectronics	1	1	2
		VAC/IKS	VAC-247	The Bhagavad Gita – Philosophy	2	-	2

Exit Option: Students existing the programme after securing **44** credits will be awarded an **Advanced UG Certificate in Biological Sciences** provided they secure **4** credits in work-based vocational courses offered by the institute during the summer term.

Detailed Syllabus for Sem-I and Sem-II

Programme Outcomes (POs)

Upon completion of the programme, students will be able to:

- **PO1** Understand the fundamental concepts of biological sciences at molecular, cellular and organismal levels.
- **PO2** Develop laboratory skills in microbiology, biochemistry, botany and zoology.
- **PO3** Apply interdisciplinary knowledge including chemistry, statistics and computational tools in biological sciences.
- **PO4** Demonstrate communication skills, scientific writing and data interpretation abilities.
- **PO5** Understand ethical issues related to biosafety, bioethics and intellectual property rights.
- **PO6** Demonstrate leadership, teamwork and lifelong learning skills.

PROGRAMME SPECIFIC OUTCOME (PSOs)

At the end of the Integrated M.S. program in Biological Science, the students will be able to:

PSO1 Acquire conceptual understanding of biological processes and diversity.

PSO2 Apply biological knowledge to agriculture, medicine, environment and biotechnology.

PSO3 Perform laboratory experiments using appropriate scientific techniques.

PSO4 Conduct research investigations and interpret experimental data.

PSO5 Develop entrepreneurial mindset for biotechnology and life science industries

BSM111 (T): Introduction to Bioscience I

Semester: I	Course Title: Foundations of Bioscience I	Credit: 4
Course Code: BSM111 (T)		4 hours/week

COURSE OUTCOMES (COS)

CO	Bloom's Level	Course Outcome
CO1	Remember	Describe the fundamental chemical components of living systems including biomolecules and cellular structures.
CO2	Understand	Explain the structural organization and diversity of microorganisms, plants and animals.
CO3	Apply	Apply the concepts of biological structure–function relationships in microbes, plants and animals.
CO4	Analyze	Analyze metabolic processes and energy transformations occurring in biological systems.
CO5	Evaluate	Compare structural and functional characteristics across different biological groups.

Unit 1: Foundations of Microbiology I Teaching Hours: 15

Sr. No.	Topic	Teaching Hours
1	Introduction to Microbial Life: Definition, Origin and History, Classification and Diversity	**2**
2	Microbial Structure and Function: A: Prokaryotic microbial structure (Bacteria): Cell wall, plasma membrane, ribosomes, nucleoid, Capsule, endospore B. Eukaryotic Microbial Structure: Fungi - Cell wall (chitin), membrane (ergosterol), Hyphae vs yeast forms; Protozoa - Unicellular eukaryotic organization, Locomotory structures (flagella, cilia, pseudopodia), Parasitic vs free-living forms (conceptual); Algae - Photosynthetic microbes, Chloroplasts and pigments C. Viruses: Viral structure: capsid, envelope, Genome types (DNA/RNA, ss/ds).	**4**
3	Applications of Micro-organisms with a focus on industrial applications: Biochemical factories, Disease agents, Ecological Engineers, Vaccine	**6**

Unit 2: Foundations of Biochemistry I **Teaching Hours: 15**

Sr. No.	Topic	Teaching Hours
1	Introduction: Chemical Basis of Life; Concept: different types of bonds, pH, buffer	**3**
2	Carbohydrates and Lipids: Classification, Structure and Function of carbohydrate and lipid	
3	Proteins and Enzymes: Amino acids and peptide bonds, Protein structure: primary to quaternary; Enzymes: properties, specificity, factors affecting activity	**3**
4	Nucleic Acids and Energy Molecules: DNA and RNA: structure and biological role, Central dogma concept; Energy rich compounds, ATP and, NAD, NADP, FAD and their role in ETS.	**3**
5	Role of macromolecules and micro molecules in nutrition and diet	**3**

Unit 3: Foundations of Zoology I **Teaching Hours: 15**

Sr. No.	Topic	Teaching Hours
1	Introduction: Overview of animal diversity, Level of organization	**15**
2	Diversity of Invertebrate: Classification up to class level with examples and Ecological importance → Protozoa → Porifera → Coelenterata → Helminthes → Annelida → Arthropoda → Mollusca → Echinodermata	
3	Diversity of Chordates: Classification up to orders giving two examples → Prochordata → Pisces → Amphibia → Reptilia → Aves → Mammalia	

Unit 4: Foundations of Botany I **Teaching Hours: 15**

Sr. No.	Topic	Teaching Hours
1	Plant Diversity (a) Algae: Introduction, Classification (G. A. Smith), Economic importance- In Industry & As Biofertilizers (b) Fungi: Introduction, Classification (G. C. Ainsworth), Economic importance- In Industry, Production of Organic acids (c) Bryophytes: Introduction, Classification (Rothmaler), Economic importance- Peat (d) Pteridophytes: Introduction, Classification (Riemer), Economic importance- In Horticulture & As Biofertilizers (e) Gymnosperms: Introduction, Classification (Chamberlain), Economic importance- Timber & Resins (f) Angiosperms: Diversity in Habit, Economic Importance- Spices	**15**
2	Plant tissues and vascular structure (a) Simple tissue & Complex tissue (b) Structure of Root (c) Structure of Stem (d) Structure of Leaf	
3	Basic plant physiology: (a) Photosynthesis: Basic mechanism of light and dark reactions, C_3, C_4 & CAM pathways (b) Respiration: Aerobic VS anaerobic respiration (c) Plant water relationship: Diffusion, Osmosis, Transpiration	

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2. Pelczar, M. J., Chan, E. C. S., & Krieg, N. R. *Microbiology* – McGraw-Hill
3. Nelson, D. L., & Cox, M. M. *Lehninger Principles of Biochemistry* – W.H. Freeman
4. Voet, D., Voet, J. G., & Pratt, C. W. *Fundamentals of Biochemistry* – Wiley
5. Satyanarayana, U., & Chakrapani, U. *Biochemistry* – Elsevier
6. Miller, S. A., & Harley, J. P. *Zoology* – McGraw-Hill
7. Kent, G. C., & Miller, L. *Comparative Anatomy of the Vertebrates* – McGraw-Hill
8. Raven, P. H., Evert, R. F., & Eichhorn, S. E. *Biology of Plants* – W.H. Freeman
9. Taiz, L., Zeiger, E., Møller, I. M., & Murphy, A. *Plant Physiology and Development* – Sinauer
10. Pandey, B. P. *Plant Anatomy* – S. Chand
11. Campbell, N. A. et al. *Campbell Biology* – Pearson

BSM112 (P): PRACTICALS

Semester: I	Course Title: Foundations of Bioscience I	Credit: 4
Course Code: BSM112 (P)		8 hours/week

CO	Bloom's Level	Course Outcome
CO1	Remember	Identify laboratory instruments and explain their basic functions used in biological laboratories.
CO2	Understand	Explain principles behind microbiological staining, biochemical tests and chromatography techniques.
CO3	Apply	Perform laboratory techniques such as preparation of solutions, bacterial staining and qualitative biochemical tests.
CO4	Analyze	Examine plant tissues and animal specimens to interpret structural diversity.
CO5	Evaluate	Interpret experimental observations and present laboratory results in a scientific format.
CO6	Create	Prepare laboratory reports with appropriate data recording, diagrams and interpretation.

1) Introduction to Bioscience lab and safety rules
    - Glasswares, Bunsen Burner,
    - Key terms: Inoculation, aseptic technique, Sterilization, Culture techniques
2) Study and working principle of:
    - Compound microscope
    - Autoclave
    - Hot air oven
    - Incubator
    - Centrifuge
    - pH meter
    - Micropipettes
3) Preparation of standard solutions: Normality, Molarity, Molality and percent solutions (v/v, w/v)
4) Simple staining and Negative staining
5) Gram staining of bacterial cell
6) Qualitative test for Carbohydrates: Monosaccharide, Disaccharide

7) Paper chromatography: Separation of amino acids or plant pigments
8) Study of Algae: *Gracilaria* and *Nostoc*
9) Study of Fungi: *Yeast* and *Aspergillus*
10) Study of Bryophyta: *Sphagnum*
11) Study of Pteridophyta: *Nephrolepis*
12) Study of Gymnoperm: *Pinus*
13) Economic importance of Spices
14) Demonstration of Osmosis, diffusion and transpiration
15) Animal diversity: Invertebrate specimens/charts (Protozoa to Echinodermata)
16) Animal diversity: Vertebrate specimens/charts (Pisces to Mammalia)

BSE113 Foundations of Biostatistics

Semester: I	**Course Title: Foundations of Biostatistics**	**Credit: 2**
Course Code: BSE113 (T)		**Hours: 2/week**

Unit 1 — Data & Descriptive Statistics
– Nature & scope of statistics in biology
– Types of data: nominal, ordinal, interval, ratio
– Measures of central tendency: mean, median, mode
– Measures of dispersion: range, variance, SD, CV
– Frequency distributions & graphical representation

Unit 2 — Probability & Sampling
– Basic probability rules; addition & multiplication laws
– Probability distributions: binomial, Poisson, normal
– Standard normal distribution & z-scores
– Central Limit Theorem & biological relevance
– Sampling methods, sampling error & bias

BSE113 (P): Foundations of Biostatistics

Semester: I	Course Title: Foundations of Biostatistics	Credit: 2
Course Code: BSE113 (P)		Hours: 4/week

– Data entry, types & formatting in Excel
– Descriptive statistics using built-in functions
– Frequency tables, histograms & bar charts
– Box plots & scatter plots for biological data
– Normal distribution curves with NORM.DIST
– Analysis ToolPak for summary statistics
– Cleaning & organising messy biological datasets
– Case study: plant growth measurement data

CHMDC114 (T): Chemical Bases of Life

Semester: I	Course Title: Chemical Bases of Life	Credit: 2
Course Code: CHMDC114		Hours: 2/week

Course outcomes:

CO — 1. Gain knowledge of protein and polypeptide, their classification, structure, importance as bio molecules and their role in biochemical processes.

CO — 2. Describe the introduction of soaps and detergents, their manufacturing and applications in day to day life and apply the knowledge in various industries as well as inter disciplines.

CO-PO mapping (connecting COs with POs)

co	PO-I	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
co-I	3	2	1	1		2		
co-2	3	3	1	1			1	1

UNIT — I - Protein and polypeptide [15 Hours]

Introduction to protein and polypeptide, Geometry of peptide bond, synthesis of amide bond, 1^0, 2^0 and 3^0 structure of protein, Methods for C and N terminal residues.

UNIT - II - Lipids [15 Hours]

Occurrence and composition of fat, Hydrolysis of fat, soap miceller, fats as pure sources of acids and alcohols, detergents, unsaturated fats, hardening of oil, drying oils.

Reference books

1. 'Organic Chemistry' Morrison, R. T. and Boyd, R.N. 6th Ed. 1992, Prentice Hall International, Inc., London.
2. Handbook of Industrial Chemistry: Organic Chemicals, 1st Edition . Mohammad Farhat Ali, • Bassam M. El Ali, James G. Speight, 2005, McGrawHill Education
3. Perfumes Soaps Detergents & Cosmetics Volume 1, 1 st addition, (Soaps & Detergents, S. C.Bhatia, 2009, Dattani book agency.

CHMDC114 (P): Chemical Bases of Life

Semester: I	Course Title: Chemical Bases of Life	Credit: 2
Course Code: CHMDC113		Hours: 4/week

Safety Practices in the chemistry laboratory, identification of different apparatus, knowledge about toxic chemicals and safety precautions in their handling, how to proper uses of different glass wares.

(I) Titrimetric analysis

(a). Calibration of glassware and use of apparatus to be discussed

1. Calibration of 10 ml pipette
2. Calibration of 25 ml burette
3. Calibration of 100 ml measuring flask

(b). Preparation of solutions of different Normality, Molarity and %V/V, %W/V, %W/W to be discussed

(II) Acid base titrations

(a). Principle of Acid base titration to be discussed

(b). Preparation of standard solutions of 0.1 N Succinic acid, 0. 1 N Hydrous & Anhydrous Oxalic acid, 0. 1 N NaOH.

1. Std. Succinic acid (0. 1 N) → NaOH / KOH
2. Std. Hydrous & anhydrous Oxalic acid (0. 1 N) → NaOH / KOH
3. Std. NaOH (using Succinic acid) (0. 1 N) → HCI

(III) REDOX TITRATION

(a). Preparation of standard solutions of (0.05N) $KMnO_4$ & (0.0 1 N) $K_2Cr_2O_7$

1. Std. $KMnO_4$ (0.05N) → $FeSO_4.7H_2O$ / $FeSO_4(NH_4)_2SO_4.6H_2O$

2. Std. $K_2Cr_2O_7$ (0.05N) $\rightarrow$ $FeSO_4.7H_2O$ / $FeSO_4$ $(NH_4)_2SO_4.6H_2O$

(IV) Complexometry Titration
a). Preparation of standard solutions of (0.01M) EDTA
1. Ca^{2+} / Mg^{2+} $\rightarrow$ Std. EDTA (0.01 M)
(V) Viva-Voce questions

REFERENCE BOOKS

1. 'Vogel's Textbook of Quantitative Chemical analysis' Revised by G. H. Jeffery, J. Bassett, J. Mendham & R. C. Denney, ELBS (English Language Book Society) Longman. 5th Ed., New York.
2. 'Analytical Chemistry' by Dhruba Charan Dash, 2011, 2th Ed., PHI Learning Private Ltd, New Delhi.
3. 'Analytical Chemistry' by Gary D. Christian, 1986, 4th Ed., John Wiley & Sons.
4. 'Advanced Practical Inorganic Chemistry' by Gurdeep Raj, 9th Ed., Goel Publishing House, Meerut.
5. 'Advanced University Practical Chemistry' by P. C. Kamboj, Vishal Publishing Co., Jallandhar — Delhi.

AEC115 Language Through Literature-I

Semester: I	**Course Title: Language Through Literature-I**	**Credit: 2**
Course Code: AEC115		**Hours: 2/week**

Course Outcomes: On successful completion of the course the learner will be able to

CO	COGNITIVE ABILITIES	COURSE OUTCOMES
CO 1	REMEMBERING	
CO 2	UNDERSTANDING	Students will develop an appreciation for diverse literary forms, demonstrating an ability to analyze and interpret stories and poems in English.
CO 3	APPLYING	Students will exhibit improved grammatical competence, applying correct grammar and syntax in written and spoken communication.
CO 4	ANALYSING	Students will acquire the ability to understand and critically evaluate scientific articles, research papers, and lab reports, demonstrating improved scientific literacy.
CO 5	EVALUATING	Students will showcase overall language proficiency, enabling effective
CO 6	CREATING	

Unit	Content	Teaching Hours
I	Text: *Sparkles* (Macmillan Publication) Section – I	10
II	Text: *Sparkles* (Macmillan Publication) Section – II	10
III	Grammar **A)** BE, HAVE and DO as Lexical Verbs **B)** Tenses: • Simple Present Tense • Simple Past Tense • Simple Future Tense • Present Continuous Tense • Past Continuous • Tense Present Perfect • Tense Past Perfect • Tense Present Perfect Continuous Tense	5
IV	**A)** Comprehension of Scientific articles, scientific texts • The passage should be of 200-300 words. • The questions should measure the student's ability to comprehend the main ideas, relevant facts and arguments, and the logical relationship between various ideas and facts presented in the passage. • A total of four questions will be asked from the passage. **B)** Vocabulary (Textual Glossary)	5
V	PRACTICAL Speaking: To enable the students to • Greeting and formulae of everyday conversation • Introduce themselves • Making a request, saying no politely	10

References Books:

• *Oxford Practice Grammar (Advanced)* - George Yule – OUP.
• *Advanced Grammar in Use* - Martin Hewings - Cambridge University Press.
• *English Grammar for Students* - Anne Seaton and Y H Mew - Learner's Publishing.
• *A Practical English Grammar* - A J Thomson and A V Martinet – OUP.
• *Better English* - Betty Kirkpatrick - Geddes and Grosset.
• *Contemporary English Grammar Structures and Composition* – David Green - Trinity Press.

BSSEC**116** (A): Aquaculture and Hydroponics

Semester: I	Course Title: Aquaculture and Hydroponics	Credit: 2
Course Code: BSSEC116		Hours: 2/week

Course Credit Structure

Component	Hours	Credits
Theory	15 Hours (including evaluation)	1
Practical	30 Hours (including evaluation)	1
Total	45 Hours	2

Course Objectives

The course is designed to:

1. Introduce students to the principles of aquaculture and hydroponics.
2. Develop understanding of sustainable food production systems.
3. Familiarize students with fish culture practices and hydroponic cultivation methods.
4. Provide hands-on training in maintenance of aquaculture and hydroponic systems.
5. Promote awareness regarding integrated and urban agriculture technologies.

Course Outcomes (COs)

After completion of the course, students will be able to:

CO No.	Course Outcome
CO1	Explain basic concepts and importance of aquaculture and hydroponics.
CO2	Describe different aquaculture systems and hydroponic techniques.
CO3	Identify essential components used in fish culture and hydroponic setups.
CO4	Perform basic practical operations related to aquaculture and hydroponic cultivation.
CO5	Understand sustainable and eco-friendly food production approaches.

THEORY SYLLABUS

Total: 15 Hours (Including Evaluation)

	Topic	Hours
1	Introduction to Aquaculture: Definition, scope, history, importance, types of aquaculture systems (freshwater, brackish water, marine culture), common cultivable fish species.	4
2	Basics of Fish Farming: Fish Pond preparation, water quality parameters, fish nutrition and feed, common diseases and management practices.	3
3	Introduction to Hydroponics: Concept, advantages and limitations, essential nutrients for plants, growing media and nutrient solutions.	3
4	Hydroponic Systems and Applications: Wick system, NFT, Deep Water Culture, vertical farming, urban agriculture and sustainability.	3
Evaluation	Internal assessment / class test / viva	2

Topic	Hours
Total	**15 Hours**

PRACTICAL SYLLABUS

Total: 30 Hours (Including Evaluation)

Practical No.	Practical Title
1	Identification of common aquaculture equipment and tools
2	Study of cultivable freshwater fish species
3	Measurement of water quality parameters: pH, temperature, dissolved oxygen
4	Preparation of simple fish feed formulation
5	Demonstration of fish pond/tank maintenance
6	Identification of common hydroponic systems
7	Preparation of nutrient solution for hydroponics
8	Germination and seedling preparation for hydroponic cultivation
9	Cultivation of leafy vegetables using hydroponic setup
10	Study of different growing media used in hydroponics
11	Maintenance and monitoring of hydroponic systems
12	Mini project/report on sustainable farming practices
Evaluation	Practical viva, journal and practical examination

Teaching Methodology

- Classroom lectures
- Demonstration-based learning
- Laboratory practicals
- Field visit/virtual tour (if feasible)
- Assignment and mini-project

Scheme of Evaluation

Theory (25 Marks)

Component	Marks
Assignment	05
CIE	10
Semester-end Theory Examination	10

Practical (25 Marks)

Component	Marks
Practical Performance and Journal	10
Viva Voce	5
Practical Examination / Project	10

Reference Books

1. Principles of Aquaculture
   Authors: Dr. C. J. Khune, Dr. Rajendra V. Tijare, Dr. S. R. Sitre & Prof. S. B. Zade
   Publisher: Himalaya Publishing House
   Suitable for Indian UG and PG students with practical aquaculture concepts. (Himalaya Publishing House)
2. Freshwater Aquaculture
   Author: R. K. Rath
   Publisher: Scientific Publishers, Jodhpur
   Focuses on Indian freshwater aquaculture systems and management. (scientificpubonline.com)
3. Handbook on Freshwater Aquaculture
   Editors: N. P. Singh & B. Santhosh
   Publisher: New India Publishing Agency (NIPA)
   Includes Indian farming practices, water quality, integrated fish culture and rural aquaculture. (nipabooks.com)
4. Cage Aquaculture in India
   Authors: G. Syda Rao, Imelda Joseph, K. K. Philipose & M. Suresh Kumar
   Publisher: Central Marine Fisheries Research Institute (CMFRI), Kochi
   Excellent Indian reference for modern aquaculture practices. (NHBS)
5. Hydroponics: Modern Technology to Sustain Agriculture
   Author: Vivek Kumar
   Publisher: New India Publishing Agency / IBP
   Covers hydroponics under Indian climatic and agricultural conditions. (IBP Books)
6. Aquaponics: Principles and Practices
   Authors: G. Pathmanaban et al.
   Publisher: Agrobios (India)
   Particularly useful because it integrates aquaculture and hydroponics together. (IBP Books)
7. Indian Council of Agricultural Research (ICAR) Manuals on Fisheries, Aquaculture and Protected Cultivation
   Publisher: ICAR Publications, New Delhi
8. Junagadh Agricultural University Extension Literature and Fisheries/Agriculture Publications
   Useful for Gujarat-specific agricultural and fisheries practices. (Wikipedia)
9. Anand Agricultural University Training Manuals on Protected Cultivation and Urban Farming
10. Navsari Agricultural University Horticulture and Soilless Cultivation Extension Publications

IKS117 Indian Knowledge Systems

Semester: I	Course Title: Indian Knowledge Systems	Credit: 2
Course Code: IKS117		Hours: 2/week

Objectives of the Course

• This course is designed to understand and enhance the holistic understanding of Indian Knowledge System.
• This course provides the basic understanding of the rich Indian knowledge system and its traditions.
• The course will introduce to the various ancient Indian Schools and its relevance in contemporary period with the great achievements of IKS to the world.
• It helps in understanding and analyzing the Ancient Indian knowledge system.

Outcomes of the Course

Learners will be able to…
• Understand the contribution of Indian minds in various fields
• Learn about the leading Indian inventors and thinkers in various disciplines
• Develop a positive attitude towards Indian traditions and practices
• Increase subject-awareness and self-esteem
• Develop a comprehensive understanding of how all knowledge is ultimately

Unit	Topic	Teaching Hours
I	**Introduction to IKS** o Introduction to IKS and its importance	15
	o Various IKS Systems o Shashtra – Foundational Literature of Bharatvarsha What is Shashtra? Importance of Shashtra Classification of Shashtra – Vedic and Avedic (with examples of important Literature)	
	o Base of IKS proliferation Bhartiya Education System and its philosophy History of BES from Ancient to Modern Domains of Education: Gurukul, Pathshala, Vidhyalay, Vishva vidhyalay	

II	**Contribution of IKS to the World**	**15**
	Mathematics &Astronomy Trigonometry	
	Number System Planetary System	
	Algebra & Arithmetic Speed of Light Geometry Eclipse o Life sciences o Metal Technology Physics Mining Techniques Chemistry Types of Metals Botany Tools & Techniques for Metal Smelting with examples	
	o Town planning &Temple Architecture	
	Indigenous tools & technologies for town planning & Temple Architecture Lothal, MohanJoDaro, Dholavira Angkorvat, Lepakshi Temple, Jagannath Puri Temple, Thanjavur Temple, Modhera and Konark Sun Temple, Hampi Temple Etc.	
	o Ayurveda Introduction of Ayurveda- Definition, Branches of Ayurveda, Books and Pioneers Concept of Tridosh and the importance of its Balance in the body Indic Medical Science Achievement: Tools & Technology	
	o Art &Traditions History and Origin Science behind our traditions and rituals	

Reference Books:

- Introduction to Indian Knowledge System-Concept and Application by B. Mahadevan, Vinayak Rajat Bhat, Nagendra Pavan R.N.
- R.M.Pujari, Pradeep Kolhe, N.R. Kumar, 'Pride of India: A Glimpse into India's Scientific Heritage', Samskrita Bharati Publication.
- 'Indian Contribution to science', compiled by Vijnana Bharati.
- 'Knowledge Traditions and Practices of India', Kapil Kapoor, Michel Danino, CBSE, India.
- Dr. Subhash Kak, Computation in Ancient India, Mount, Meru Publishing (2016)
- Dharampal, Indian Science and Technology in the Eighteenth Century, Academy of Gandhian Studies, Hyderabad, 1971, republ. Other India Bookstore, Goa, 2000
- Robert Kanigel, The Man Who Knew Infinity: A Life of the Genius Ramanujan, Abacus, London, 1999
- Alok Kumar, Sciences of the Ancient Hindus: Unlocking Nature in the Pursuit of Salvation, CreateSpace Independent Publishing, 2014
- B.V. Subbarayappa, Science in India: A Historical Perspective, Rupa, New Delhi, 2013
- S. Balachandra Rao, Indian Mathematics and Astronomy: Some Landmarks, Jnana Deep Publications, Bangalore, 3rd ed., 2004.

BSM121 (T): Introduction to Bioscience II

Semester: II	Course Title: Foundations of Bioscience II	Credit: 4
Course Code: BSM121 (T)		4 hours/week

CO	Bloom's Level	Course Outcome
CO1	Remember	Describe microbial nutrition, growth patterns and host–microbe interactions.
CO2	Understand	Explain metabolic pathways of carbohydrates, lipids and proteins involved in cellular metabolism.
CO3	Apply	Apply knowledge of bioenergetics to understand ATP generation and metabolic regulation.
CO4	Analyze	Analyze structure and function of animal cells, tissues and organ systems.
CO5	Evaluate	Assess physiological processes responsible for homeostasis in organisms.
CO6	Create	Integrate knowledge of plant growth regulators and environmental responses to explain plant development.

Unit 1: Foundations of Microbiology II **Teaching Hours: 15**

Sr. No.	Topic	Teaching Hours
1	Microbial Nutrition and Metabolic Diversity: Nutritional requirements of microorganisms with respect to carbon, energy and electron source	**5**
2	Microbial Growth and Reproduction: Cell division, Microbial growth curve and its phases, Factors affecting microbial growth	**4**
3	Aseptic and Pure culture techniques	**3**

Unit 2: Foundations of Biochemistry II **Teaching Hours: 15**

Sr. No.	Topic	Teaching Hours
1	Carbohydrate metabolism and introduction to associated metabolic disorders	**3**
2	Lipid metabolism and introduction to associated metabolic disorders	**3**
3	Protein metabolism and introduction to associated metabolic disorders	**3**
4	Bioenergetics, Regulation and integration of metabolic pathways	**3**

Unit 3: Foundations of Zoology II **Teaching Hours: 15**

Sr. No.	Topic	Teaching Hours
1	Animal Cell: Cell organelles	**15**
2	Structure and functions of Animal tissues (Human): → Epithelial tissue → Connective tissue → Muscular tissue → Nervous tissue	
3	Organ Systems: (Human) → Digestive system → Respiratory system → Circulatory system	
4	Integration of organ systems and maintenance of homeostasis (human)	

Unit 4: Foundations of Botany II **Teaching Hours: 15**

Sr. No.	Topic	Teaching Hours
	Plant Physiology (a) Growth and development in plants (b) Role of macronutrients and micronutrients on growth and development of plants (c) Physiological roles of Hormones: Auxin, Gibberellin, Cytokinin, Abscisic acid and Ethylene (d) Types of Seed dormancy and methods to break seed dormancy (e) Seed germination: Types, Stages and factors affecting (f) Senescence	**15**

REFERENCE

1. Prescott, L. M., Harley, J. P., & Klein, D. A. *Microbiology* – McGraw-Hill
2. Pelczar, M. J., Chan, E. C. S., & Krieg, N. R. *Microbiology* – McGraw-Hill
3. Nelson, D. L., & Cox, M. M. *Lehninger Principles of Biochemistry* – W.H. Freeman
4. Voet, D., Voet, J. G., & Pratt, C. W. *Fundamentals of Biochemistry* – Wiley
5. Satyanarayana, U., & Chakrapani, U. *Biochemistry* – Elsevier
6. Miller, S. A., & Harley, J. P. *Zoology* – McGraw-Hill
7. Kent, G. C., & Miller, L. *Comparative Anatomy of the Vertebrates* – McGraw-Hill
8. Raven, P. H., Evert, R. F., & Eichhorn, S. E. *Biology of Plants* – W.H. Freeman
9. Taiz, L., Zeiger, E., Møller, I. M., & Murphy, A. *Plant Physiology and Development* – Sinauer
10. Pandey, B. P. *Plant Anatomy* – S. Chand
11. Campbell, N. A. et al. *Campbell Biology* – Pearson

BSM122 (P):
PRACTICALS

Semester: II	Course Title: Foundations of Bioscience II	Credit: 4
Course Code: BSM122 (P)		8 hours/week

CO	Bloom's Level	Course Outcome
CO1	Remember	Identify common laboratory instruments and explain their functions used in biological experiments.
CO2	Understand	Explain principles of staining techniques, chromatography and biochemical tests.
CO3	Apply	Perform basic laboratory procedures including solution preparation, staining and biochemical tests.
CO4	Analyze	Examine plant tissues and animal specimens to understand structural diversity.
CO5	Evaluate	Interpret experimental observations and relate them to theoretical biological concepts.
CO6	Create	Record experimental observations and prepare structured laboratory reports with diagrams and results.

1) Preparation and sterilization of culture medium (Nutrient Agar/ Nutrient Broth)

2) Bacterial Growth:
   - Solid media (streak plate method)
   - Liquid media (turbidity)

3) Estimation of protein (Biuret method / Lowry method)

4) Estimation of sugar (DNS method or Nelson Somogyii method)

5) Animal tissue: Epithelial, connective, muscular, nervous tissues (slides)

6) Physiological systems: Digestive, respiratory, circulatory systems (human model)

7) Bleeding time and clotting time

8) Preparation of blood smear and differential WBC

9) Blood grouping

10) Demonstration of mineral deficiency symptoms in plants (Charts or live samples)

11) Demonstration of growth through Arc indicator

12) Demonstration of role of Auxin (Phototropism)

13) Demonstration of role of Ethylene (Abscission)

14) Demonstration of role of Cytokinin (Senescence)

BSE123 (T): Statistical inference and Hypothesis

Semester: II	Course Title: Statistical inference and Hypothesis	Credit: 2
Course Code: BSE123 (T)		2 hours/week

Unit 1: Estimation & Parametric Tests

– Confidence intervals; point & interval estimation

– Hypothesis formulation: H_0, H_1, p-values, α-level

– Type I & Type II errors; statistical power

– One-sample, two-sample & paired t-tests

– One-way ANOVA & post-hoc tests (Tukey, Bonferroni)

Unit 2: Non-Parametric Tests & Test Selection

– Mann-Whitney U test & Wilcoxon signed-rank test

– Kruskal-Wallis test as non-parametric ANOVA

– Chi-square: independence & goodness-of-fit

– Fisher's exact test for small biological samples

– Statistical test decision framework for biosciences

Semester: II	Course Title: Statistical Inference & Hypothesis Testing	Credit: 2
Course Code: BSE123 (P)		4 hours/week

BSE123 (P): Practical Cmponent

– Jamovi interface, data import & variable coding

– t-tests on real biological datasets

– One-way ANOVA with post-hoc analysis

– Chi-square tests: blood types, phenotype ratios

– Mann-Whitney U on non-normal biological data

– Normality checks: Shapiro-Wilk & Q-Q plots

– Effect size: Cohen's d, η^2, Cramér's V

– Case studies: drug trials, enzyme activity data

CHMDC124 (T): Industrial Chemistry

Semester: II	Course Title: Industrial Chemistry	Credit: 2
Course Code: CHMDC124		Hours: 2/week

Course outcomes:

At the end of the course the student will be able to-

CO -1. Know about industrial products, their preparations, manufacturing, uses and market tends.

CO -2. Apply the knowledge understand, analyse and solve the problem with environmental impact.

CO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6
CO-1	3	2	1			
CO-2	3	2	1	1	1	

UNIT 1 Explosives and Pesticides [15 hours]

[A] Explosives: Introduction, classification, synthesis and uses of Tetryl, PETN, HMTA, RDX, Nitro glycerine

[B] Pesticides: Introduction, classification, synthesis and uses of Malathione, Parathione, Aldrin, Methoxychlor and DDT.

Unit 2 Drugs and Dyes [15 hours]
[25 marks]

[A] Drugs: Introduction, classification, synthesis and uses of Aspirin, Paracetamol, Phenacetin, Antipyrin, Benzocaine, tolbutamine, n-hexyl resorcinol

[B] Dyes: Introduction, General classification, synthesis and uses of Malachite green, Indigo, Alizarin, Congo red, Eosin

REFERENCE BOOK

1. 'Shreve's Chemical process Industry by George T. Austin, 2017
2. 'Organic chemistry' by I. L. Finar, Volume 2, Pearson Education, 1996
3. 'Burger's medicinal chemistry and drug design' (5/e) 1997, vol 1 to 5 edited by Manfred E.Woltt (John wiley and sons Mc. New york)
4. 'Medicinal chemistry' by Ashutoshkar
5. 'Principles of medicinal chemistry' by William A. Foye (ied), lea and febiys (Philadelphia

CHMDC**124** (P): Chemistry Practical

Semester: II	Course Title: Chemistry Practical	Credit: 2
Course Code: CHMDC124 (P)		Hours: 4/week

ORGANIC QUALITATIVE ANALYSIS

Concept of types of organic compound, lassaigne's elements, Organic functional groups, water soluble/ insoluble compounds, Aromatic character, MP/ BP and their measurement, Chemical properties of different organic compounds.

Organic spotting
Acids:
Solid: Benzoic acid, Salicylic acid, Succinic acid, Oxalic acid

Phenol:

Solid: alpha-naphthol & beta-naphthol

Base:

Solid: p-nitroaniline
Liquid: Aniline

Neutral:
Solid: Urea, Thiourea, Naphthalene
Liquid: Acetone, Ethanol, Ethyl acetate, Benzaldehyde, Nitrobenzene, Chloroform

DEMONSTRATION

Purification of organic compounds

1. Simple distillation

Introduction to distillation, Types of distillation, Principle of simple distillation, purification of organic liquid by distillation.

2. Crystallization

Introduction to crystallization, purification of benzoic acid by crystallization.

3. Sublimation

Introduction to Sublimation, purification of Naphthalene by sublimation.

REFERENCE BOOKS

1. I Vogel, "Elementary Practical Organic Chemistry Part-II, Qualitative Organic Analysis", CBS Publishers & Distributers, New Delhi, Second Edition, 2004.
2. V.K. Ahluwalia, Sunita Dhingra, "Comprehensive Practical Organic Chemistry – Qualitative Analysis", University Press (India) Private Limited, Hyderabad, First Indian Edition, 2010.
3. Mohan Jag, "Organic Analytical Chemistry theory and Practice", Narosa Publication, New Delhi, 2003. 5. J Leonard, B Lygo, G Procter, "Advanced Practical Organic Chemistry", Stanley Thornes (Publishers) Ltd., First Indian Edition, 2004.

AEC125 Language Through Literature-II

Semester: II	**Course Title: Language Through Literature-II**	**Credit: 2**
Course Code: AEC125		**Hours: 2/week**

Course Outcomes: On successful completion of the course the learner will be able to

CO	COGNITIVE ABILITIES	COURSE OUTCOMES
CO 1	REMEMBERING	
CO 2	UNDERSTANDING	Students will demonstrate an increased interest in reading stories and poems in English, developing a habit of literary exploration.

CO 3	APPLYING	Students will exhibit proficiency in identifying and using different sentence types, articles, and question tags in written and spoken
CO 4	ANALYSING	Students will apply learned grammatical concepts effectively in communication, showcasing improved language precision
CO 5	EVALUATING	Students will be adept at constructing grammatically correct sentences in
CO 6	CREATING	Students will demonstrate the ability to choose and use appropriate words and expressions in various contexts, enhancing their communication skills in English

Unit	Content	Teaching Hours
I	Text: *Sparkles* (Macmillan Publication) Section – III	10
II	Text: *Sparkles* (Macmillan Publication) Section– IV	10
III	Grammar **A)** Articles **B)** Types of Sentences • Question Tags	10
IV	Practical **A)** Jumbled Sentences **B)** Cloze Test • The passage for the Cloze Test will contain a total of four blanks (one mark each) and for each blank three options will be given. Describing scientific processes/ experiments	10

References Books:

• Oxford Practice Grammar (Advanced) - George Yule – OUP.
• Advanced Grammar in Use - Martin Hewings - Cambridge University Press.
• English Grammar for Students - Anne Seaton and Y H Mew - Learner's Publishing.
• A Practical English Grammar - A J Thomson and A V Martinet – OUP.
• Better English - Betty Kirkpatrick - Geddes and Grosset.
• Contemporary English Grammar Structures and Composition – David Green - Trinity Press.

BSSEC**126 (A)** - Agro tourism and Wildlife tourism

Semester: II	Course Title: Agro tourism and Wildlife tourism	Credit: 2
Course Code: BTSEC126		Hours: 2/week

Credit Structure

Component	Hours	Credits
Theory	15 Hours (including evaluation)	1
Practical	30 Hours (including evaluation)	1

Component Hours		Credits
Total	45 Hours	2

Course Objectives

1. To introduce students to the concepts of agrotourism and wildlife tourism.
2. To develop awareness regarding sustainable tourism and biodiversity conservation.
3. To familiarize students with rural tourism opportunities and wildlife resources of India and Gujarat.
4. To provide practical exposure to tourism planning and eco-friendly tourism practices.
5. To encourage entrepreneurship and community participation in tourism sectors.

Course Outcomes (COs)

After successful completion of the course, students will be able to:

CO No.	Course Outcome
CO1	Explain basic concepts and scope of agrotourism and wildlife tourism.
CO2	Identify important tourism resources and wildlife destinations in India and Gujarat.
CO3	Describe sustainable tourism and conservation practices.
CO4	Demonstrate basic tourism planning and visitor management skills.
CO5	Understand entrepreneurship opportunities in rural and wildlife tourism sectors.

THEORY SYLLABUS

Total: 15 Hours (Including Evaluation)

	Topic	Hours
1	**Introduction to Tourism and Agrotourism**: Meaning, types and importance of tourism; concept and scope of agrotourism; rural culture, farm tourism and entrepreneurship opportunities.	4
2	**Wildlife Tourism and Biodiversity**: Wildlife tourism concept; biodiversity of India and Gujarat; national parks, wildlife sanctuaries and ecotourism destinations.	4
3	**Sustainable Tourism Practices**: Eco-friendly tourism, wildlife conservation, responsible tourism, role of local communities and government initiatives.	3
4	**Tourism Management Basics**: Visitor management, hospitality services, tourism promotion and preparation of simple tourism itineraries.	2
Evaluation	Internal test / assignment / viva	2
Total		**15 Hours**

PRACTICAL SYLLABUS

Total: 30 Hours (Including Evaluation)

Practical No.	Practical Title
1	Study of different forms of tourism in India
2	Identification of major agrotourism centers in Gujarat
3	Preparation of tourism map showing wildlife sanctuaries and national parks of Gujarat
4	Case study of successful agrotourism models
5	Study of biodiversity and wildlife species of Gujarat
6	Preparation of simple travel itinerary for wildlife/agrotourism visit

Practical No.	Practical Title
7	Survey of tourist expectations and visitor behavior
8	Preparation of brochure/poster for tourism promotion
9	Study of eco-friendly tourism practices
10	Visit to agrotourism farm/wildlife interpretation center/local tourism site
11	Seminar presentation on wildlife conservation or rural tourism
Evaluation	Practical journal, viva voce and practical examination

Teaching Methodology

- Classroom lectures
- Demonstration and case studies
- ICT-enabled teaching
- Group discussions and seminars
- Educational visits and field exposure

Suggested Reference Books (Indian Context)

1. Agro-Tourism
   Publisher: Himalaya Publishing House
2. Tourism Development: Principles and Practices
   Publisher: Sterling Publishers Pvt. Ltd.
3. Ecotourism and Sustainable Development
   Publisher: Kanishka Publishers
4. Wildlife Tourism
   Publisher: Atlantic Publishers
5. Biodiversity and Wildlife Conservation
   Publisher: Aavishkar Publishers
6. Indian Council of Agricultural Research Training Manuals on Rural and Farm Tourism
7. Gujarat Tourism and Forest Department Publications on Gir, Nal Sarovar and Eco-tourism initiatives.

Suggested Field Visits

- Local agrotourism farms/ National parks/ Bird Sanctuary

VAC127 Interpersonal Skills

Semester: II	Course Title: Interpersonal Skills	Credit: 2
Course Code: VAC127		Hours: 2/week

Course Outcomes: On successful completion of the course the learner will be able to

CO	COGNITIVE ABILITIES	COURSE OUTCOMES
CO 1	REMEMBERING	Identify and analyze different communication styles and understand their strengths and weaknesses
CO 2	UNDERSTANDING	Demonstrate active listening skills and questioning styles to explore issues and enhance understanding
CO 3	APPLYING	Identify conflict response styles; approach and effectively mediate workplace conflicts.
CO 4	ANALYSING	Determine ways to build and maintain trust and increase your influence and eminence in the workplace
CO 5	EVALUATING	
CO 6	CREATING	

Unit	Topics	Teaching Hours
I	Effective Communication 1. Art of Listening • Introduction • What is listening? • Benefits of active listening • Factors that hamper listening • Common poor listening habits. 2. Art of Speaking • Art of public speaking • Importance of public speaking • Public speaking tips • Overcoming fear of public speaking 3. Art of Writing E -mail • Introduction • The mail magic • Use of appropriate salutations • Make the subject matter significant • Reread before pressing the "send" button – Be polite, and reciprocate good deeds	15
II	Team Building and Conflict Management 1. Body Language 2. Body language in building interpersonal relations –Body language in building industrial relations 3. Interpreting body language Developing confidence with correct body language. Skill needed for teamwork	15

Reference

1. Soft Skills Know Yourself and Know the World, Author: Dr. K. ALEX, Publication: S. CHAND, First Edition: 2009, Reprint: 2023
2. Barnlund, Dean C. "A Transactional Model of Communication," in Foundations of Communication Theory, eds. Kenneth K. Sereno and C. David Mortensen (New York, NY: Harper and Row, 1970), 83–92.
3. Burleson, Brant R. Sandra Metts, and Michael W. Kirch, "Communication in Close Relationships, A Sourcebook, eds. Clyde Hendrick and Susan S. Hendrick (Thousand Oaks, CA: Sage, 2000).
4. Dance, F. E. X. (1972). Speech Communication; Concepts and Behavior. New York: Holt, Rinehart, and Winston.
5. Frank E. X. Dance and Carl E. Larson, The Functions of Human Communication: A Theoretical Approach (New York, NY: Holt, Reinhart, and Winston, 1976)
6. Ellis, Richard and Ann McClintock, You Take My Meaning: Theory into Practice in Human Communication (London: Edward Arnold, 1990).
7. Robert H. Gass and John S. Seiter, Persuasion, Social Influence and compliances Gaining (Boston, MA: Allyn and Bacon, 1999)
8. Erving Goffman, The Presentation of Self in Everyday Life (New York, NY: Anchor Books, 1959)
9. Greene, Kathryn, Valerian J. Derlega, and Alicia Mathews, "Self-Disclosure in Personal Relationships," in The Cambridge Handbook of Personal Relationships, eds. Anita L. Vangelisti and Daniel Perlman (Cambridge: Cambridge University Press, 2006).
10. Hargie, Owen. Skilled Interpersonal Interaction: Research, Theory, and Practice (London: Routledge, 2011).
11. National Association of Colleges and Employers, Job Outlook 2011 (2010): 25.