SDGI GLOBAL UNIVERSITY

School of Sciences (SOS)

Bachelor of Science

(Hons) Biotechnology
Undergraduate Programmes

(*w.e.f. Academic Year 2025-26***)**

As Per National Education Policy 2020

SDGI GLOBAL UNIVERSITY
NH-9, Delhi-Hapur Road, NCR, Ghaziabad, Uttar Pradesh 201015

National Education Policy 2020

Objectives: The proposed new structure for the undergraduate programs of the university aims toachieve the following key goals enunciated by the National Education Policy 2020 (NEP-2020:

Multi-disciplinary and inter-disciplinary learning
Holistic curriculum (including teaching of Indian and International languages, ethics andculture, social and emotional learning and co-curricular activities)
Skill enhancement (including skills relating to information technology and data analysis)
Research to be incorporated as a key component of the learning process
Adoption of appropriate pedagogies to promote active student participation in the learningprocess so as to promote creativity and a spirit of exploration and adventure
Capacity building for gaining as well as creating employment.
Engagement with industry and society (including dissertations, projects and internships)
Enhancing prospects for socially and economically disadvantaged and differently abledstudents.
Provision for credit transfer in both national and international contexts

Bachelor of Science (Honors) in Biotechnology (Three Years / Four Years):

In the first three years of the new program, students shall study the following courses in additionto the courses that exist in the current B.Sc. Program:

Language and Literature -II: The current BSc Program includes only one language course (English/MIL) The new program structure would require students to study two 'Language and Literature' courses, of which at least one should be in an Indian Language (IL).

Social and Emotional Learning: An interdisciplinary course that promotes well-being and health.

Innovation and Entrepreneurship: An interdisciplinary course that helps students acquire skills relating to creative social and business entrepreneurship, and organizational skills.

Co-curricular: Co-scholastic activities such as music, art, gardening, sports.

Ethics and Culture: An interdisciplinary course that shall include experience of community service.

Multidisciplinary and Research: In the fourth year (semesters VII and VIII), students can choose one discipline out of the three disciplines that they have pursued in the first three years of study, and study six courses in this discipline. (The discipline courses offered will aim to strengthen fundamental knowledge in the discipline). Students would also be required to complete a researchdissertation on the Major discipline of study, and an inter-disciplinary research dissertation on the Major and Minor disciplines of study.

Introduction

The B.Sc. Biotechnology program, structured in accordance with the National Education Policy (NEP) 2020, offers a dynamic and multidisciplinary curriculum aimed at fostering scientific temperament, innovation, and skill-based learning. Emphasizing flexibility, holistic development, and academic excellence, this curriculum integrates core concepts of biology, chemistry, and technology with hands-on laboratory experience and research-oriented learning.

The program is designed to promote a strong foundation in biotechnology, while allowing students the freedom to explore allied disciplines through a multidisciplinary approach. With a focus on competency-based education, the curriculum includes multiple entry and exit options, skill enhancement courses, internships, and project-based learning to ensure the development of critical thinking, problem-solving abilities, and ethical reasoning.

Aligned with the vision of NEP 2020, the B.Sc. Biotechnology curriculum aims to nurture professionals equipped with the knowledge and skills needed to contribute to the growing sectors of healthcare, agriculture, environmental sustainability, and industrial biotechnology. It prepares students for higher education, research, entrepreneurship, and employment, fostering lifelong learning and adaptability in a rapidly evolving scientific landscape.

The National Education Policy which was effective till now was formulated almost 34 years ago. A more felicitous vision was needed to meet the aspirations of the New India. The National Education Policy (NEP) 2020 is an ambitious and futuristic policy that strives to remove rigid boundaries and create new possibilities for students to choose and learn the subjects or courses oftheir choice.

The policy proposes a large number of changes that can transform higher education in India. One such change that has caught everyone's attention is changing the 3-year undergraduate course structure into a 4-year pattern with multiple entry and exit points to make higher education more suited to get jobs later. At present, students who leave the course in between are labelled as drop- outs and they get no qualification certificate or diploma for the credits earned during the period inthe college.

NEP 2020 seeks to pave the way for flexible and lifelong learning and encourages students to choose their academic path leading to the award of certificate, diploma, and degree. Hence, Multiple Entry and Exit System (MEES) is the corner stone of the new National Education Policyin higher education. The system allows students to drop their course and resume it at a later stageas and when they desire or deem it worth pursuing. This arrangement will prove to be a boon for those students who cannot continue their studies due to financial, social or any other reason and desire to resume their studies when the conditions become favorable in due course of time.

How the system will function?

As per the draft of the NEP 2020 the undergraduate degree will be of either 3 or 4-year duration with multiple entry and exit options within this period, with appropriate certifications — a certificate after completing 1 year in a discipline or field including vocational and professional areas, a diploma after 2 years of study, or a Bachelor's degree after a 3-year programme. The 4- year programme may also lead to a degree 'with Research' if the student completes a rigorous research project in the major area(s) of study as specified by the higher education institution.

NEP 2020 states that innovative and flexible curricular structure under multiple entry and exit points will abolish the currently prevalent rigid, uniform and mechanical structure to create new possibilities for students to choose and learn the subjects of their choice as per their preference, convenience, or necessity.

Major benefits associated with the NEP system can be outlined as under:

Benefits of Multiple Entry and Exit System (MEES)

This is a kind of stress-buster move. It is likely to reduce the pressure of pursuing a course with an opportunity of zero year loss in the academic journey. The move is likely to become a big boon for the students as they do not need to fear about losing a year or two if they have been studying one course for two years already when they plan to move into a different one.A large number of undergraduates quit the course after one or two year with zero benefitafter paying huge fee and spending their valuable time.Awarding certificate or diploma after completing 1 or 2 years will have some worth in the long run.Students will have the greater flexibility and liberty to join a course or leave a course asthey like, and they shall be also provided the opportunities to change the courses if they want to learn about a different sector as per their future career needs.Increasing Gross Enrolment Ratio at higher education is one of the objectives of NEP 2020.This move will reduce the drop-out rates of students especially for those who want to switch courses and desire to re-enter as and when they deem fit to resume their studies to earn full fledge college degree.The credits that the students obtain in their first and second year will be stored using theAcademic Bank of Credits (ABC) system. So, at any point of time, if students want to take a break and continue their course within a fixed period, they can utilise these credits for further education.The system will allow students to take a sabbatical and then join back their studies withoutlosing any credits. The move will allow students to build their own degrees. Students shall be granted more autonomy than before to decide what kind of major and minor courses they want to pursue.This is likely to revolutionize higher education system in India as only interested studentswill complete the degree through multiple entries and exit point system. Those who are notinterested to pursue the course shall have no compulsion to complete the same by all means.This path breaking move will make our higher education system more like the global
format with continuous reforms in this direction.

Effectiveness of Multiple Entry and Exit System (MEES)

In the light of above stated facts, multiple entry and exit system seems to be a very positive change.

However, a more in-depth analysis of the concept raises few practical hitches as well.Hence, following concerns need to be addressed for the effective implementation of Multiple Entry and Exit System (MEES). Concerns to be addressed

Students can exit after one year with a certificate, after two years with a diploma and a Bachelor's degree after three years and Bachelor's with research after 4 years. Curriculumconstruction is a big challenge in implementing this system. What type of proficiency willbe attained by a student after one or two year of a degree course? Thus, curriculum needs to be reworked in order to incorporate the specialized competencies, knowledge and skillsrequired in a particular subject area

In the absence of proper guidance, confusions and doubts can arise in the minds of the students leading to a state of chaos. Student support services need to be encouraged and developed at different levels for students who are more likely to drop out due to personal,social, emotional, cultural, and economic or any other reason.

What type of opportunities will be available for the certificate and diploma holders in different sectors at the same time when degree holders are finding it hard to get jobs? Students may face difficulty to find employment on the basis of an early certificate or diploma unless it is technically specialized.

Shall we be able to develop a pool of efficient entrepreneurs by awarding certificate and diploma after completing 1 or 2 years of a course through multiple entry and exit points? There is an apprehension of treating early exit certificates as a stamp of failure in the worldof work.

Educational institutions are required to develop a hassle free mechanism of admissions while implementing this system. The situation is likely to become critical, suppose when the total intake of a degree course is fixed in a particular institution. How to tackle the situation when under this system suppose 15 students decide to exit in the second semesterand about 25 students who left years ago are in queue for entry? Obviously, it will disturb the required teacher-pupil ratio and other infrastructural facilities available in the institution.

Another concern that is bothering everybody is that a large population of the students who will leave the courses in between may not return back due to some trivial reasons. It is to be ensured that a large section of the students may not get deprived of higher education in the absence of strong motivation and proper guidance.

The execution of this system in its true spirit needs to develop an impeccable mechanism of fees at the time of admission under multiple entry option. It is to be ensured that the system may not become a golden opportunity for private or other institutions to charge exorbitant fees from students who seek entry back to resume their studies.

Proposed Curriculum Frame Work -4 Years B.Sc. Programme – Biotechnology

	Major	Minor	IDC/MDC	AEC	SEC	VAC	
Sem.							
I	CC-04	CC-03	GEC-03	AEC-02	SEC-03	VAC-03	**22**
	CC-04						
II	CC-04	CC-03	GEC-03	AEC-02	SEC-03	VAC-03	**22**
	CC-04						
Students on exit shall be awarded Certificate in "Techniques in Biotechnology" after securing the requisite 44 credits in Semester I & II							
III	CC-04	CC-03	GEC-03	AEC-02	SEC-03		**22**
	CC-04	CC-03					
IV	CC-04	CC-03		AECC-02			
	CC-04	CC-03					
	CC-04						20
Students on exit shall be awarded "Diploma in Biotechnology" after securing the requisite 86 credits on completion of Semester IV							
V	CC-04	CC-03					
	CC-04	CC-03					
	CC-04						
	CC-04						22
VI	CC-04	CC-03					
	CC-04	CC-03			INT-04		**22**
	CC-04						
Students on exit shall be awarded "Bachelor (H.) in Biotechnology" after securing the requisite 130 credits on completion of Semester VI							
VII	CC-05	CC-03					
	CC-05	CC-03					
	CC-04						20
VIII	CC-05	CC-03					
	CC-05	CC-03					
	CC-04						20
VIII	CC-04	CC-04				Dissertation/ Major Project-12	20
Students on exit shall be awarded "Bachelor of Biotechnology (Honours with Research)"							

As Per National Education Policy 2020

Program Educational Objectives (PEO)

PEO 1: Graduates will establish themselves in their careers or pursue higher studies in biotechnology and related fields by leveraging their knowledge of biological sciences, laboratory techniques, and interdisciplinary applications.

PEO 2: Graduates will exhibit critical thinking and problem-solving abilities in various industries, research institutions, and academic roles while addressing scientific, technological, and societal challenges in biotechnology.

PEO 3: Graduates will demonstrate professional and ethical responsibility, effective communication skills, and teamwork in multidisciplinary environments, contributing to sustainable development and innovation in biotechnology.

PEO 4: Graduates will continuously engage in lifelong learning and stay abreast of new developments in biotechnology through research, innovation, and professional growth.

Program Specific Outcomes (PSO)

PSO 1: Apply fundamental concepts and laboratory techniques in molecular biology, genetics, biochemistry, microbiology, and bioinformatics to solve real-world problems in biotechnology.

PSO 2: Utilize skills in data analysis, experimental design, and critical thinking to carry out research and industrial projects in areas such as genetic engineering, pharmaceutical biotechnology, and environmental biotechnology.

PSO 3: Demonstrate proficiency in advanced biotechnology techniques and tools used for bioprocessing, protein engineering, genomics, and bio-manufacturing.

PSO 4: Engage in interdisciplinary and collaborative work, contributing to innovations in biotechnology, healthcare, agriculture, and environmental sectors.

Program Outcomes (PO)

PO 1: **Knowledge of Biotechnology**: Gain a comprehensive understanding of the structure and function of biomolecules, cellular processes, genetics, and microbiology, and their applications in biotechnology.

PO 2: **Scientific Reasoning**: Develop the ability to critically analyze and interpret scientific data, formulate hypotheses, and design experiments to address biotechnological challenges.

PO 3: **Laboratory Skills**: Acquire proficiency in modern laboratory techniques such as PCR, electrophoresis, spectrophotometry, chromatography, and bioinformatics tools.

PO 4: **Research and Innovation**: Demonstrate the ability to conduct independent and collaborative research, contribute to the development of new biotechnological solutions, and publish scientific findings.

PO 5: **Ethical and Social Responsibility**: Practice ethical conduct in research, biotechnology industry, and community interactions, while understanding the impact of biotechnology on health, environment, and society.

PO 6: **Communication Skills**: Develop effective communication skills for disseminating scientific knowledge, collaborating with multidisciplinary teams, and engaging with stakeholders in the biotechnology industry.

PO 7: **Lifelong Learning**: Recognize the importance of lifelong learning and staying updated with emerging trends, technologies, and scientific discoveries in the field of biotechnology.

Using Bloom's Taxonomy to Write Effective Learning Outcomes

Remembering: Retrieving, recognizing, and recalling relevant knowledge from long-term memory.

Understanding: Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.

Applying: Carrying out or using a procedure for executing, or implementing.

Analyzing: Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing.

Evaluating: Making judgments based on criteria and standards through checking and critiquing.

Creating: Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.

SDGI GLOBAL UNIVERSITY, GHAZIABAD

SCHOOL OF SCIENCES

ND EVALUATION SCHEME FOR BACHELOR OF SCIENCE

EPARTMENT OF LIFE SCIENCES (BIOTECHNOLOGY)

BRANCH: - B.Sc. (Biotechnology) as per NEP 2020

SESSION - 2025-26

SEMESTER - 1st

S. No	Status	Subject Code	Subject Name	Study Scheme Lec/ Week			Hours	Credits	Marks in Evaluation Scheme						Passing Marks	Total Marks
									Continuous Internal Evaluation (CIE)			End of Semester Examination (ESE).				
				L	T	P			Th	Pr	Total	Th	Pr	Total		
1	DSC (Core/Major)	B100324101	Biochemistry & Metabolism	3	0	0	3	3	50	-	50	50	-	50	40	100
2	DSC (Core/Major)	B100324102	Cell Biology & Signaling	3	0	0	3	3	50	-	50	50	-	50	40	100
3	DSE (Minor)	B100324103	Bio-instrumentation	3	0	0	3	3	50	-	50	50	-	50	40	100
4	GE	B10GE2401	Entrepreneurship and IPR	3	0	0	3	3	50	-	50	50	-	50	40	100

5	AEC	BSGUAE2401	English Language Proficiency	2	0	0	2	2	50	-	50	50	-	50	40	100
6	VAC	BSGUVA2404	Introduction to Indian Constitution	3	0	0	3	3	50	-	50	50	-	50	40	100
7	SEC	BSGUSE2410	Office Automation	2	0	0	2	2	25	-	25	25	-	25	20	50
8		BSGUSE2460	Office Automation-Lab	0	0	1	2	1		30	30		20	20	20	50
9	Practical	B100324151P	Biochemistry & metabolism Practical	0	0	1	2	1	-	60	60	-	40	40	40	100
10	Practical	B100324152P	Cell Biology Practical	0	0	1	2	1		60	60	-	40	40	40	100
			*Courses host By SWAYAM					3								
				19+3=22		**3**		**25**								**900**

SEMESTER - 2nd

S. No	Status	Subject Code	Subject Name	Study Scheme Lec/ Week			Hours	Credits	Marks in Evaluation Scheme						Passing Marks	Total Marks
									Continuous Internal Evaluation (CIE)			End of Semester Examination (ESE).				
				L	T	P			Th	Pr	Total	Th	Pr	Total		
1	DSC (Core/Major)	B100324201	Basics of Microbiology	3	0	0	3	3	50	-	50	50	-	50	40	100
2	DSC (Core/Major)	B100324202	Enzyme biotechnology	3	0	0	3	3	50	-	50	50	-	50	40	100
3	DSE (Minor)	B100324203	Molecular Biology	3	0	0	3	3	50	-	50	50	-	50	40	100

4	GE	B10GE2402	Research methodology And ethics	3	0	0	3	3	50	-	50	50	-	50	40	100
5	AEC	BSGUAE2406	Team building & Leadership	2	0	0	2	2	50	-	50	50	-	50	40	100
6	VAC	BSGUVA2401	Environmental Education	3	0	0	3	3	50	-	50	50	-	50	40	100
7	SEC	BSGUSE2414	Essential Techniques in Life Sciences-1	2	0	0	2	2	25	-	25	25	-	25	20	50
8		BSGUSE2464	Essential Techniques in Life Sciences-1-Lab	0	0	1	2	1		30	30		20	20	20	50
9	Practical	B100324251P	Basics ofMicrobiology Practical	0	0	1	2	1	-	60	60	-	40	40	40	100
10	Practical	B100324252P	Enzyme biotechnology Practical	0	0	1	2	1		60	60	-	40	40	40	100
			*Courses host By SWAYAM					3								
				19+3=22		**3**		**25**								**900**

(Certificate in "Techniques in Biotechnology")

SEMESTER - 3rd

S. No	Status	Subject Code	Subject Name	Study Scheme Lec/ Week			Hours	Credits	Marks in Evaluation Scheme						Passing Marks	Total Marks
									Continuous Internal Evaluation (CIE)			End of Semester Examination (ESE).				
				L	T	P			Th	Pr	Total	Th	Pr	Total		
1	DSC (Core/Major	B100324301	Genetics	3	0	0	3	3	50	-	50	50	-	50	40	100

	)															
2	DSC (Core/Major)	B100324302	Bioinformatics	3	0	0	3	3	50	-	50	50	-	50	40	100
3	DSE (Minor)	B100324303	Pharmaceuticals Biotechnology	3	0	0	3	3	50	-	50	50	-	50	40	100
4	DSE (Minor)	B100324304	Computational Biology and Drug Discovery	3	0	0	3	3	50	-	50	50	-	50	40	100
5	GE	B10GE2409	Food, Nutrition and Health	3		0	3	3	50	-	50	50	-	50	40	100
6	AEC	BSGUAE2405	Research Writing Skills	2	0	0	2	2	50	-	50	50	-	50	40	100
7	SEC	BSGUSE2413	Reasoning & aptitude learning	2	0	0	2	2	25	-	25	25	-	25	20	50
8		BSGUSE2463	Reasoning & aptitude learning Practical	0	0	1	2	1		30	30		20	20	20	50
9	Practical	B100324351P	Genetics Practical	0	0	1	2	1	-	60	60	-	40	40	40	100
10	Practical	B100324352P	Bioinformatics Practical	0	0	1	2	1		60	60	-	40	40	40	100
			*Courses host By SWAYAM					3								
				19+3=22		**3**		**25**								**900**

SEMESTER - 4th

S. No	Status	Subject Code	Subject Name	Study Scheme Lec/ Week	Hours	Credits	Marks in Evaluation Scheme		Passing Marks	Total Marks
							Continuous Internal Evaluation (CIE)	End of Semester Examination (ESE).		

				L	T	P			Th	Pr	Total	Th	Pr	Total		
1	DSC (Core/Major)	B100324401	Bioprocess Engineering	4	0	0	4	4	50	-	50	50	-	50	40	100
2	DSC (Core/Major)	B100324402	Cell Tissue Culture Technology	4	0	0	4	4	50	-	50	50	-	50	40	100
3	DSC (Core/Major)	B100324403	Recombinant DNA Technology	3	0	0	3	3	50	-	50	50	-	50	40	100
4	DSE (Minor)	B100324404	Microbial Technology	3	0	0	3	3	50	-	50	50	-	50	40	100
5	DSE (Minor)	B100324405	Information Technology for biologists	3	0	0	3	3	50	-	50	50	-	50	40	100
6	AEC	BSGUAE2404	Professional Communication	2	0	0	2	2	50	-	50	50	-	50	40	100
7	Practical	B100324451P	Bioprocess Engineering Practical	0	0	1	2	1		60	60	-	40	40	40	100
8	Practical	B100324452P	Cell and Tissue Culture Technology Practical	0	0	1	2	1	-	60	60	-	40	40	40	100
9	Practical	B100324453P	Recombinant DNA Technology Practical	0	0	1	2	1	-	60	60	-	40	40	40	100
			*Courses host By SWAYAM					3								
				19+3=22		**3**		**25**								**900**

(Diploma in Biotechnology)

SEMESTER - 5th

S. No	Status	Subject Code	Subject Name	Study Scheme Lec/ Week			Hours	Credits	Marks in Evaluation Scheme						Passing Marks	Total Marks
									Continuous Internal Evaluation (CIE)			End of Semester Examination (ESE).				
				L	T	P			Th	Pr	Total	Th	Pr	Total		
1	DSC (Core/Major)	B100324501	Fermentation Technology	3	0	0	3	3	50	-	50	50	-	50	40	100
2	DSC (Core/Major)	B100324502	Genomics and Proteomics	3	0	0	3	3	50	-	50	50	-	50	40	100
3	DSC (Core/Major)	B100324503	Immunology	3	0	0	3	3	50	-	50	50	-	50	40	100
4	DSC (Core/Major)	B100324504	Diseases and Healthcare	3	0	0	3	3	50	-	50	50	-	50	40	100
5	DSE (Minor)	B200324505	Virology	3	0	0	3	3	50	-	50	50	-	50	40	100
6	DSE (Minor)	B200324506	Biostatistics & math's	3	0	0	3	3	50	-	50	50	-	50	40	100
7	Practical	B100324551P	Fermentation Technology Practical	0	0	1	2	1	-	60	60	-	40	40	40	100
8	Practical	B100324552P	Genomics and Proteomics Practical	0	0	1	2	1	-	60	60	-	40	40	40	100
9	Practical	B100324553P	Immunology Practical	0	0	1	2	1	-	60	60	-	40	40	40	100
			*Courses host By SWAYAM					3								
				18+3-21		**3**		**24**								**900**

SEMESTER - 6th

S. No	Status	Subject Code	Subject Name	Study Scheme Lec/ Week			Hours	Credits	Marks in Evaluation Scheme						Passing Marks	Total Marks
									Continuous Internal Evaluation (CIE)			End of Semester Examination (ESE).				
				L	T	P			Th	Pr	Total	Th	Pr	Total		
1	DSC (Core/Major)	B100324601	Animal Biotechnology	3	0	0	3	3	50	-	50	50	-	50	40	100
2	DSC (Core/Major)	B100324602	Plant Biotechnology	3	0	0	3	3	50	-	50	50	-	50	40	100
3	DSC (Core/Major)	B100324603	Human Anatomy & Physiology	3	0	0	3	3	50	-	50	50	-	50	40	100
4	DSE (Minor)	B100324604	Ecology & Environmental Biotechnology	3	0	0	3	3	50	-	50	50	-	50	40	100
5	DSE (Minor)	B100324605	Food Technology	3	0	0	3	3	50	-	50	50	-	50	40	100
6	INTERNSHIP	B100324691I	Research Based Project learning-Internship					4								200
7	Practical	B100324651P	Plant Biotechnology Practical	0	0	1	2	1		60	60	-	40	40	40	100
8	Practical	B100324652P	Animal Biotechnology Practical	0	0	1	2	1		60	60	-	40	40	40	100
			*Courses host By SWAYAM					3								
				15+3=18		**2+4=6**		**24**								**900**

SEMESTER - 7th

S. No	Status	Subject Code	Subject Name	Study Scheme Lec/ Week			Hours	Credits	Marks in Evaluation Scheme						Passing Marks	Total Marks
									Continuous Internal Evaluation (CIE)			End of Semester Examination (ESE).				
				L	T	P			Th	Pr	Total	Th	Pr	Total		
1	DSC (Core/Major)	B100324701	Stem cell Technology	4	0	0	4	4	50	-	50	50	-	50	40	100
2	DSC (Core/Major)	B100324702	Nanotechnology	4	0	0	4	4	50	-	50	50	-	50	40	100
3	DSC (Core/Major)	B100324703	Medical Biotechnology	4	0	0	4	4	50	-	50	50	-	50	40	100
4	DSE (Minor)	B100324704	Herbal Drug Technology	3	0	0	3	3	50	-	50	50	-	50	40	100
5	DSE (Minor)	B100324705	Disease and Omics Technology	3	0	0	3	3	50	-	50	50	-	50	40	100
6	Practical	B100324751P	Stem cell Technology Practical	0	0	1	2	1	-	60	60	-	40	40	40	100
7	Practical	B100324752P	Nanotechnology Practical	0	0	1	2	1		60	60	-	40	40	40	100
			*Courses host By SWAYAM					3								
				18+3=21		**2**		**23**								**700**

SEMESTER - 8th

S. No	Status	Subject Code	Subject Name	Study Scheme Lec/ Week			Hours	Credits	Marks in Evaluation Scheme						Passing Marks	Total Marks
									Continuous Internal Evaluation (CIE)			End of Semester Examination (ESE).				
				L	T	P			Th	Pr	Total	Th	Pr	Total		
1	DSC (Core/Major)	B100324801	Microbial Diversity and Taxonomy	4	0	0	4	4	50	-	50	50	-	50	40	100
2	DSC (Core/Major)	B100324802	Introduction to Nano-toxicology	4	0	0	4	4	50	-	50	50	-	50	40	100
3	DSC (Core/Major)	B100324803	Application of Industrial Biotechnology	4	0	0	4	4	50	-	50	50	-	50	40	100
4	DSE (Minor)	B100324804	Advanced Molecular Biotechnology	3	0	0	3	3	50	-	50	50	-	50	40	100
5	DSE (Minor)	B100324805	Vaccine Biotechnology	3	0	0	3	3	50	-	50	50	-	50	40	100
6	Practical	B100324851P	Microbial Diversity and Taxonomy Practical	0	0	1	2	1	-	60	60	-	40	40	40	100
7	Practical	B100324852P	Introduction to Nano-toxicology Practical	0	0	1	2	1		60	60	-	40	40	40	100
			*Courses host By SWAYAM					3								
				18+3=21		**2**		**23**								**700**

(Degree in B.sc Honours)

SEMESTER - 8th

S. No	Status	Subject Code	Subject Name	Study Scheme Lec/ Week			Hours	Credits	Marks in Evaluation Scheme						Passing Marks	Total Marks
									Continuous Internal Evaluation (CIE)			End of Semester Examination (ESE).				
				L	T	P			Th	Pr	Total	Th	Pr	Total		
1	DSC (Core/Major)	B100324806	Advanced Research Methodology	4	0	0	4	4	50	-	50	50	-	50	40	100
2	DSE (Minor)	B100324807	Publication ethics in Research	4	0	0	4	4	50	-	50	50	-	50	40	100
3	PROJECT	B100324892P	Major Project					12	Project Report & Viva-Voce							500
			*Courses host By SWAYAM					3								
				8+3=11		**12**		**23**								**700**

(Degree in B.sc Honours with Research)

Course Status system: Every course will be coded as follows:

Abbreviations	Subject Category/status
DSC (Core/Major)	Discipline Specific Course (Core/Major)
DSE (Elective /Minor)	Discipline Specific Course Elective /(Minor)
OE OR GE	Interdisciplinary course/Multidisciplinary/OE/GE
AEC	Ability Enhancement Compulsory Courses
SEC	Skill Enhancement Courses
VAC	Value Addition Courses

Dissertation	**Dissertation**
Project	**Project**
Internship	**Internship**

*SWAYAM based on online credit courses.- SWAYAM is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.(1) The schedule of the SWAYAM based online credit courses shall be aligned with the conventional education semester commencing in the month of January and July of every year. (2) The SWAYAM based online credit courses shall be developed, delivered and assessed only by the course-coordinator. (3) The course and course-coordinator shall be identified by the National Coordinator in accordance with the SWAYAM guidelines with the prior approval of the SWAYAM Board. (4) The course-coordinator shall offer the SWAYAM based online credit courses through the Host Institution which shall issue the certificate with grades after the end term proctored examination for credit transfer. (5) The list of SWAYAM based online credit courses for the ensuing semester shall be notified on the SWAYAM platform before the 1st November for the January semester and before the 1st June for the July semester, every year.

Course Module

Semester-01

BIOCHEMISTRY & METABOLISM

School Name- School of sciences			
Program- B.sc (H) Biotechnology			Semester-1st
Course Name- Biochemistry and metabolism			
A.Y-2025-2026	CourseCode:B100324101	Batch-2025-2029	CIE Marks-50(MM)
Total Teaching Hours-45	Total Credits-3-0-0		ESE Marks- 50 (MM)
Type of Course- Theory			Total Marks- 100 (MM)

Course Objective:

To study the structure and function of macromolecules present in biological systems, understanding the general properties of lipids, amino acids and carbohydrates, to learn the hierarchical level of proteins & to study the structure as well as properties of DNA and RNA

Course Description:

This course comprises of the structure, function, properties and significance of various macromolecules found in biological systems. Several different macromolecules viz. lipids, carbohydrates, amino acids, proteins, and nucleic acids will be studied in detail.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	Unit I: Classification and Study of macromolecules: Biochemistry and its scope Structure; general properties and function of cellular Biomolecules; bonds (Covalent, non-covalent bonds, hydrophilic and hydrophobic interactions, hydrogen bonding and their influence on structure of biomolecules) & Water.	9

2	Unit II: Carbohydrate & metabolism: Introduction and classification of carbohydrate; Glucose Metabolism: Glycolysis; fermentation; anaerobic fate of pyruvate; regulation of glycolysis; pentose phosphate pathway; Citric Acid Cycle: Synthesis of acetyl-coenzyme A; enzymes of the citric acid cycle; regulation of the citric acid cycle; Glycogen Metabolism and Gluconeogenesis: Glycogen breakdown; glycogen synthesis; regulation of glycogen metabolism.	9
3	Unit III: Lipid & Metabolism: Introduction and classification of Lipids, Digestion; absorption and transport; fatty acid oxidation; ketone bodies; regulation of fatty acid metabolism; cholesterol biosynthesis; fatty acid biosynthesis & its regulation. General introduction of vitamins.	9
4	Unit IV: Protein & metabolism: Introduction to protein & Amino Acids, isoelectric point, classification of protein, Structure of peptide bond; Denaturation of Protein; Metabolism of protein. Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, Cofactors, coenzyme, prosthetic groups, activation energy and transition state, enzyme activity, specific activity.	9
5	Unit V: Nucleic Acids: Structure and functions:; Nitrogenous bases (purines & pyrimidines), Nucleosides & Nucleotides, Biologically important nucleotides, Double helical model of DNA, Introduction and structure forces responsible for A, B & Z DNA, Chemical structures of DNA (Watson-Crick Model) and RNA, Explanation of Hydrogen bonding between the two DNA molecules, Significance of DNA and RNA; nucleotide metabolism.	9

Course Outcomes:

1. Understanding Bimolecular Structure and Interactions
2. Identify the structure, functions of carbohydrates and its metabolism.
3. Proficiency in understanding of Lipid, Fatty acids & vitamins with Lipid, Fatty acids

Metabolism

4. Comprehensive Knowledge of Enzymes & Protein Structure and Metabolism.
5. In-depth Understanding of Nucleic Acid Structure, function and metabolism.

Text Books:

- A.L., Lehninger, PRINCIPLES OF BIOCHEMISTRY (1982), Worth Publishers, Inc. New York, ISBN: 9780716743392, 0716743396
- L. Stryer, BIOCHEMISTRY (1995) W.H. Freeman Press, San Francisco, USA, ISBN: 9781319248086, 131924808X.

Reference Books:

- Voet, D. and Voet, J.G., Biochemistry, (2004). 3rd Edition, John Wiley & Sons, Inc.USA,
- U. Sathyanarayana, Biochemistry by Books and Allied (P) Ltd. Kolkata, ISBN 0-87893- 214- 3, (2014), ISBN: 9788187134800, 8187134801

Assessment method: (Continuous Internal Assessment = 50%, Final Examination = 50%)

CELL BIOLOGY & SIGNALING

School Name- School of Sciences			
Program-B.sc(H) Biotechnology			Semester-1st
Course Name- Cell biology and Signalling			
A.Y-2025-2026	Course Code: B100324102	Batch-2025-2029	CIE Marks-50 (MM)
Total Teaching Hours-45	Total Credits-3-0-0		ESE Marks-50 (MM)
Type of Course- Theory			Total Marks-100 (MM)

Course Objective:

To provide students the knowledge about cellular content, organization, structures and functions. To impart basic understanding of development biology and interaction of cells with the environment.

Course Description:

It is an introductory cell biology course. Topics include the structure of the cell and cell components, both eukaryotic and prokaryotic. The processes of DNA replication and gene expression including protein processing and routing. Photosynthesis, respiration, and chemotroph as means of energy production. The cell cycle and its regulation. These topics will be covered in one semester having four-hour lectures and one two-hour laboratory work per week.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	Unit I: Basics of Cell Biology (Structure & Function): Discovery of cell and Cell Theory; Comparison between plant and animal cells; Cell wall; Plasma membrane; Modification of plasma membrane and intracellular junctions; Cytoskeleton; Protoplasm; Mitochondria;	9

	Chloroplast; ER; Golgi complex; Lysosome, endosome and microbodies; Ribosome; Centriole; Nucleus; Chemical components of a cell Biosynthesis of mitochondria, chloroplast, ER, Golgi complex; Biosynthetic process in ER and Golgi apparatus;; Degradation of cellular components.	
2	Unit II: Chromosomes: Chemical composition, structural organization of chromatids, centromeres, telomeres, chromatin, nucleosome organization, eu- and heterochromatin, special chromosomes (e.g. polytene and lampbrush chromosomes), banding patterns in human chromosomes.	9
3	Unit III: Membrane Structure and Transport: Models of membrane structure, Membrane lipids, proteins and carbohydrates; Solute transport by Simple diffusion, Facilitated diffusion and Active transport; Cell adhesion	9
4	Unit IV: Cell Cycle: An overview of cell cycle; Mitosis and meiosis; Components of cell cycle control system; Programmed cell death (Apoptosis), intrinsic & extrinsic pathways of cell death, Apoptosis in relation with Cancer, Viral disease (AIDS) & Organ transplant.	9
5	Unit V: Cell biology and signaling: Signal Transduction and G Protein– Coupled Receptors- Signaling, G Protein–Coupled Receptors: Structure and Mechanism. Protein–Coupled Receptors That Regulate Ion Channels, G Protein–Coupled Receptors That Activate or Inhibit Adenylyl Cyclase, G Protein–Coupled Receptors That Trigger Elevations in Cytosolic and Mitochondrial Calcium, Receptor Serine Kinases That Activate Smads, Cytokine Receptors and the JAK/STAT Signaling Pathway Receptor Tyrosine Kinases.	9

Course Outcomes

1. To differentiate between animal as well as plant cells, different organelles & ability of enzymes to facilitate chemical reactions, Protein sorting and transport of protein. Understanding of the biochemical processes.
2. Explain about various Chemical compositions of nucleic acids (DNA/RNA).

3. Explain about various Cellular membrane structure and function.
4. An understanding of how cells grow, divide, cell cycle, cell Death and various processes associated. Analyse the signaling pathways That Control Gene Expression.

Text Books:

1. Jeff Hardin, Gregory Bertoni, Lewis J. Kleinsmith, Wayne M. Becker. Becker's World of the Cell, 8th edition, Benajmin Cummings, 9780321689634, 0321689631, (2012).

2. EDP De Robertis and EMF De Robertis. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, 9780781734936, 0781734932, (2006).

Reference Books:

1. Gerald Karp, Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc, 9780470483374, 0470483377 (2010)

2. G.M. Cooper, and R.E. Hausman. The Cell: A Molecular Approach. 5th Edition. ASM Press 780878931064, 0878931066 (2009)

Assessment method: (Continuous Internal Assessment = 50%, Final Examination = 50%)

BIO-INSTRUMENTATION

School Name- School of Sciences			
Program-B.sc(H) Biotechnology			Semester-1st
Course Name- Bio- Instrumentation			
A.Y-2025-2026	Course Code: B100324103	Batch-2025-2029	CIE Marks-50 (MM)
Total Teaching Hours-45	Total Credits-3-0-0		ESE Marks-50 (MM)
Type of Course- Theory			Total Marks-100 (MM)

Course Objective:

The students learn the physical principles of structure-function relationships in biological, Macromolecules Such as proteins and nucleic acids, as well as the various approaches, techniques and instrumentation associated with structural biology.

Course Description:

This course presents the principles and applications of Biotechnology explaining the biomolecules and applications of biophysical methods. Students will be able to justify the need for buffers, describe how buffers are prepared, and calculate the amount of buffering agent needed when making a particular buffer On successful completion of the course the students will be aware of Microscopic techniques, Electro physiological methods, Biomolecules structure determination using X-Ray diffraction.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	Unit I: Biophysical methods: Introduction and Concept of pH, Measurement of pH, pOH, Buffer action. Concept of Molarity,	9

	Molality, Normality, Structure of water, polarity of water, biological functions of water inside the cell and human body.	
2	Unit II: Separation & Identification of Materials: Concept mechanism and applications of Chromatography (Partition Chromatography, Paper Chromatography, Adsorption Chromatography, TLC, GLC, Ion Exchange Chromatography, hydrophobic chromatography, Gel Chromatography, HPLC, Affinity Chromatography); Gel Electrophoresis, Iso electric focusing, immunoelectrophoresis 2-D electrophoresis, SDS-PAGE, , Capillary electrophoresis, Pulse field electrophoresis	9
3	Unit III: Centrifugation: Basic Principle of Centrifugation, Instrumentation of Ultracentrifuge (Preparative, Analytical), Factors affecting Sedimentation velocity, Standard Sedimentation Coefficient, rotor types, Rate-Zonal centrifugation, sedimentation equilibrium Centrifugation and its applications	9
4	Unit IV: Microscopy & Spectroscopy: Light microscopy, Bright & Dark Field microscopy, Fluorescence microscopy, Phase Contrast microscopy, Electron microscopy (TEM, SEM) Basic concepts, principle, working, care & maintenance of UV VIS and FT-IR Spectroscopy, NMR, MALDI-TOF mass spectroscopy.	9
5	Unit V: X-Ray Crystallography: Concept of X-ray diffraction, Bragg equation, Reciprocal lattice, Miller indices & Unit cell, Concept of different crystal structure, determination of crystal structure (concept of rotating crystal method, powder method).	9

Course Outcomes

1. Understanding Biophysical methods & concept of pH
2. Understanding chromatography, immune-techniques and electrophoresis techniques
3. Understanding and analyze the technique centrifugation.
4. Describe the Basic concept of microscopic techniques & basic principle and application spectroscopy.
5. Explain the basic principle and application of X-Ray Crystallography.

Text Books:

1. Cromwell, L. and Weibell, F.J. and Pfeiffer, E.A., Biomedical Instrumentation and Measurement, Dorling Kingsley (2006) 2nd ed.
2. Carr, J.J. and Brown, J.M., Introduction to Biomedical Equipment Technology, Prentice Hall (2000) 4th ed.
3. Wilson K and Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology. 7th Ed., Cambridge University Press.

Reference Books:

1. Geddes, L.A., and Baker, L.E., Principles of Applied Biomedical Instrumentation, Wiley InterScience (1989) 3rd ed.
2. Khandpur, R.S., Handbook of Biomedical Instrumentation, McGraw Hill (2003) 2nd ed.
3. Webster, J.G., Medical Instrumentation Application and Design, John Wiley (2007) 3rd ed.
4. Biophysical Techniques By Iain Campbell • 2012, 9780199642144, 0199642141, QUP Oxford.

Assessment method: (Continuous Internal Assessment = 50%, Final Examination = 50%)

Practical's

BIOCHEMISTRY & METABOLISM PRACTICALS

School Name- School of Sciences			
Program-B.sc(H) Biotechnology			Semester-1st
Course Name- Biochemistry and Metabolism			
A.Y-2025-2026	Course Code: B100324151	Batch-2025-2029	CIE Marks-60 (MM)
Total Teaching Hours-30	Total Credits-0-0-1		ESE Marks-40 (MM)
Type of Course- Practical			Total Marks100 (MM)

UNIT-1	Topics
1	Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch).
2	Identification tests for Proteins (albumin and Casein).
3	Estimation of Proteins by Biuret, Lowry and Bradford.
4	Qualitative analysis of urine for abnormal constituents.
5	Determination of blood creatinine.
6	Determination of blood sugar.

7	Determination of serum total cholesterol.
8	Analysis of lipid profile test.
9	Preparation of buffer solution and measurement of pH.
10	Study of enzymatic hydrolysis of starch.

CELL BIOLOGY PRACTICALS

School Name- School of Sciences			
Program-B.sc (H)Biotechnology			Semester-1st
Course Name- Cell Biology Practical			
A.Y-2025-2026	CourseCode:B100324152	Batch-2025-2029	CIE Marks-60 (MM)
Total Teaching Hours-30	Total Credits-0-0-1		ESE Marks-40 (MM)
Type of Course- Practical			Total Marks100 (MM)

S.No.	Topics
1	Observation of distinguishing features of prokaryotic and eukaryotic cells.
2	To observe the morphology of bacteria and fungi under the compound microscope.
3	To differentiate bacteria into Gram-Positive and Gram-Negative.
4	To study the morphological structure of bacteria.
5	Measurement of Onion epidermal cell
6	Preparation of blood smear and differential staining of blood cells.
7	Study of divisional stages in Mitosis and Meiosis.
8	To identify the number of cells present in the given 1 ml of blood/bacterial sample.

9	Estimation of amount of chlorophyll present in the leaf tissue
10	To identify the different types of cells present in the leaf cross section.

Assessment method: (Continuous Internal Assessment = 60%, Final Examination = 40%)

Second Semester

BASICS OF MICROBIOLOGY

School Name- School of Sciences			
Program-B.sc(H) Biotechnology			Semester-2nd
Course Name- Basics of microbiology			
A.Y-2025-2026	Course Code: B100324201	Batch-2024-2028	CIE Marks-50 (MM)
Total Teaching Hours-45	Total Credits-0-0-3		ESE Marks-50 (MM)
Type of Course- Theory			Total Marks-100 (MM)

Course Objective:

To provide foundational knowledge of microbial diversity, physiology, and techniques, emphasizing ecological roles, pathogenicity, and industrial applications while developing laboratory skills essential for biotechnology research and applications.

Course Description:

This course explores microorganisms' structure, classification, and physiology, focusing on their environmental, industrial, and medical roles. It includes practical training in microscopy, culturing, and aseptic techniques for microbiological studies.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	Unit I: Introduction, History of microbiology, contribution of various microbiologists, scope and its importance. Introduction to Prokaryotes and Eukaryotes, Study of ultrastructure and morphological classification of bacteria, fungi, protozoa, and algae, Wittaker's five kingdoms and Carl's woe's three kingdom,	9

	Classification and morphology of viruses, Viroid and Prions. Biocatalysts from extreme thermophilic and hyperthermophilic archaea and bacteria.	
2	Unit II: Growth of Bacteria, occurrence, diversity and characteristics features, Nutritional requirements, Raw materials used for culture media and physical parameters for growth, Growth curve, Isolation and preservation methods for pure cultures (streaking, pour and spread plate). Study of different types of microscopy. Batch and continuous growth of bacteria.	9
3	Unit III: Identification of bacteria using staining techniques & Designing of aseptic area Biochemical tests (Gram staining, Acid fast, IMViC); Study of principle, procedure, merits, demerits and applications. Methods of sterilization. Evaluation and efficiency of sterilization methods, Various physical and chemical methods of control of microorganisms. Laminar flow equipment; Study of different sources of contamination in an aseptic area, Methods of prevention, Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.	9
4	Unit IV: Study of morphology, Classification, Reproduction/Replication and Cultivation of Fungi and Viruses, life-cycle of bacteriophage, Viriods, Prions, lambda phage, lytic and lysogenic cycle, Classification and mode of action of disinfectants, Factors influencing disinfection, antiseptics and their evaluation.	9
5	Unit V: Types of spoilage, Factors affecting the microbial spoilage of pharmaceutical products, Sources and types of microbial contaminants, Assessment of microbial contamination and spoilage, Growth of animal cells in culture, General procedure for cell culture, Primary, established and transformed cell cultures, Application of cell cultures in pharmaceutical industry and research. Application of	9

	microbes in the medical field and benefits of probiotics.	

Course Outcomes:

1. To understand the basics of microbiology and Classification of bacteria.
2. Understand methods of identification, cultivation and preservation of various microorganisms.
3. Carried out microbiological standardization antibiotics and designing of aseptic area.
4. Learn the morphology, classification and sterility testing of microorganisms.
5. Understand the cell culture technology and its applications in pharmaceutical industries.

Text Books:

1. Lucas JA. (1998). Plant Pathology and Plant Pathogens. 3rd edition. Blackwell Science, Oxford.

2. Mehrotra RS. (1994). Plant Pathology. Tata McGraw-Hill Limited.

Reference Books:

1. Agrios GN. (2006). Plant Pathology. 5th edition. Academic press, San Diego,

Assessment method: (Continuous Internal Assessment = 50%, Final Examination = 50%)

ENZYME BIOTECHNOLOGY

School Name- School of Sciences			
Program-B.sc (H)Biotechnology			Semester-2nd
Course Name- Enzyme Biotechnology			
A.Y-2025-2026	Course Code: B100324202	Batch-2024-2028	CIE Marks-50 (MM)
Total Teaching Hours-45	Total Credits-3-0-0		ESE Marks-50 (MM)
Type of Course- Theory			Total Marks-100 (MM)

Course Objectives:

To acquire fundamental knowledge on enzymes and their importance in biological reactions, understand the difference between a chemical catalyst and a biocatalyst. Exposure to the nature of non-protein enzymes such as ribozymes and understanding the role of enzymes in clinical diagnosis and industries.

Course Description:

This course has been designed to teach the student majoring in science all the major aspects of the study of enzymes. The course focuses on the theories of enzyme kinetics, the mechanisms of enzyme catalysis, and the mechanisms of enzyme regulation in the cell.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	Unit I: Enzymes(9hr): Definition, historical perspective, general characteristics, cofactors – coenzymes and metal ions. Classification and units of enzymes: Based on IUB with examples. Unit of enzyme activity,definition of IU, enzyme turnover number and nature of non-enzymatic and enzymatic catalysis. Specific activity. Enzyme specificity. Concept of active site, ES complex, specificity.	9

2	Unit II: Theories of enzyme catalysis(7hr): Lock and key model, Koshland's induced fit theory. Enzyme kinetics: Factors affecting rate of enzyme catalyzed reactions. Mechanisms of enzyme catalysis, acid-base catalysis, covalent catalysis, metal ion catalysis	9
3	Unit III: Characterization(10hr): Effect of enzyme concentration, substrate concentration, pH and temperature. Michaelis – Menten equation, Lineweaver – Burk (L-B) plot. Determination of Vmax & Km from L-B plot and their significance. Enzyme inhibition: Competitive, Non-competitive, Uncompetitive, Reversible inhibition, mixed inhibition and suicide inhibition. Graphical representation by L-B plot. Evaluation of Km, Ki and Vmax in presence of inhibitors. Examples and mechanisms of various inhibitions such as penicillin.	9
4	Unit IV: Chemical modification (9hr) of active site groups. Site directed mutagenesis of enzymes. Mechanism of action of chymotrypsin. Allosteric enzymes: Sigmoidal curve, positive and negative modulators, Half site reactivity, Flip Flop mechanism, positive and negative cooperativity with special reference to aspartate transcarbamylase and phosphofructokinase.	9
5	Unit V: Isoenzymes, Multi enzyme complex(10hr) – Pyruvate dehydrogenase complex. – Composition, subunits, assembly, enzymatic reaction functions, RNA as an enzyme. (Ribozymes). Multifunctional enzyme-eg Fatty Acid synthase. Industrial enzymes-thermophilic enzymes, amylase, lipases, enzymes used in different fermentation processes.	9

Course Outcomes

1. To understand the fundamental knowledge on enzymes and their importance in biological reactions.
2. Students will understand the difference between a chemical catalyst and biocatalyst and understand activation energy.
3. Students will understand the characteristics and inhibition of enzyme.
4. Students will understand the Chemical modification of active site groups

5. Students will understand the Allosteric enzymes and their enzymatic reactions.

Text Books:

- Cox, M.M and Nelson, D.L. (2008). Lehninger Principles of Biochemistry, VEdition, W.H. Freeman and Co., New York.

Reference Books:

1. Voet D and Voet J(2012) Biochemistry . Fifth edition, Wiley.
2. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.

Assessment method: (Continuous Internal Assessment = 50%, Final Examination = 50%)

MOLECULAR BIOLOGY

School Name- School of Sciences			
Program-B.sc (H) Biotechnology			Semester-1st
Course Name- Molecular Biology			
A.Y-2025-2026	Course Code: B100324203	Batch-2025-2029	CIE Marks-50 (MM)
Total Teaching Hours-45	Total Credits-3-0-0		ESE Marks-50 (MM)
Type of Course- Theory			Total Marks-100 (MM)

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of Molecular Biology. This course will introduce the students with basic and advanced knowledge of molecular biology such as understanding molecular Biological processes like DNA replication, transcription, repair systems and other relevant topics.

Course Description:

This course is mainly focused on Elementary Molecular Biology which will provide the technical details and use of different gene expression systems for overexpression of recombinant proteins and protein complexes for different applications. The course will also provide details about the purification of proteins expressed in different expression systems.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	Unit I: Molecular of Life(9hr): An introduction experimental proof of DNA and RNA as genetic Material, Nucleic Acids, Structure and function of DNA and RNA, Watson and Crick model of DNA and other forms of DNA (A and Z), Functions of DNA and RNA including ribosome's. RNA structure & RNA types of RNA.	9

2	Unit II: DNA Replication(10hr): Prokaryotic and Eukaryotic-Enzymes and proteins involved in replication, Theta model and Rolling circle model. Mechanism of DNA replication, replication origin and replication fork, DNA repair, semi conservative nature of DNA replication, bi-directional replication, DNA polymerase, primosome, replisome.	9
3	Unit III: DNA Repair (8hr): Types of DNA damage, Causes and mechanism –photoreactivation, excision repair, mismatch repair, SOS repair. Recombination in prokaryotes, Transformations, Conjugation and Transduction. Wobble hypothesis, homologous recombination.	9
4	Unit IV: Transcription and Translation (11hr): Transcription in Prokaryotes and Eukaryotes, Mechanism, promoters and RNA polymerase, transcription factors, post transcriptional, modifications of a eukaryotic mRNA. Mechanism of translation in Prokaryotes and Eukaryotes. Ribosomes, mechanism of translation, post translational modification, translational inhibitors, and genetic code.	9
5	Unit V: Regulation of Gene expression (7hr): Regulation of Gene expression in Prokaryotes Person concept (Lac and Trip), Regulation of Gene expression in Eukaryotes –transcriptional activation. Transposable elements in Maize and Drosophila, gene silencing. Operon concept (inducible & repressible system), Genetic code and its characteristics.	9

Course Outcomes:

1. Students who study the molecular biology re able to understand the central dogma
2. To learn to observe how mutation can cause the change in gene expression
3. To learn various agents of DNA mutation and its repair
4. Mechanism of translation in Prokaryotes and Eukaryotes
5. Discuss the basic concept of Gene expression in the cell.

Text Books:

1. · Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the Gene, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
2. · Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP (2009) The World of the Cell, 7th edition, Pearson Benjamin Cummings Publishing, San Francisco.

Reference Books:

1. De Robertis EDP and De Robertis EMF (2006) Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia
2. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc.

Assessment method: (Continuous Internal Assessment = 50%, Final Examination = 50%)

Practical's

MICROBIOLOGY PRACTICALS

School Name- School of Sciences			
Program-B.sc (H) Biotechnology			Semester-2nd
Course Name- Basics of Microbiology Practical			
A.Y-2025-2026	Course Code: B100324251	Batch-2025-2029	CIE Marks-60 (MM)
Total Teaching Hours-30	Total Credits-0-0-1		ESE Marks-40 (MM)
Type of Course- Practical			Total Marks100 (MM)

S.No.	Topics
1	To Isolate the bacteria from soil and sewage water samples by serial dilution method.
2	To Isolate bacteria from soil samples by pour plating method.
3	Isolation and enumeration of bacteria from soil samples by the spread plate method.
4	Isolation and enumeration of microorganisms from air sources.
5	Biochemical identification of microorganisms by Gram staining.
6	Biochemical identification of microorganisms by Citrate utilization test.
7	To determine the antibiotic sensitivity of a bacterial isolate using the Kirby-Bauer disk

	diffusion method and evaluate the effectiveness of different antibiotics.
8	To determine the motility of bacteria using the Hanging Drop Method.
9	To identify Biochemical Tests for Bacterial Identification (Citrate, Carbohydrate, MR-VP).

ENZYMOLOGY BIOTECHNOLOGY PRACTICALS

School Name- School of Sciences			
Program-B.sc (H)Biotechnology			Semester-2nd
Course Name- Enzyme Biotechnology Practical			
A.Y-2025-2026	Course Code: B100324252	Batch-2025-2029	CIE Marks-60 (MM)
Total Teaching Hours-30	Total Credits-0-0-1		ESE Marks-40 (MM)
Type of Course- Practical			Total Marks-100 (MM)

UNIT-1	Topics
1	To determine the activity of α-amylase enzyme by measuring the breakdown of starch into maltose using the Dinitro salicylic Acid (DNS) method.
2	To study the effect of different temperatures on the catalytic activity of α-amylase by measuring the breakdown of starch using the Dinitro salicylic Acid (DNS) method.
3	To determine the rate constant (k) and order of reaction (n) for heating water by analyzing the temperature change over time.

4	To identify and analyze the presence of enzymes from different biological sources such as leaves, seeds, and vegetables using qualitative tests for enzyme activity.
5	To study how different pH levels affect the activity of an enzyme using buffer solutions.
6	To determine the effect of different pH levels on Controlled Reactions and enzyme activity.
7	To observe the activity of catalase in raw potato by breaking down hydrogen peroxide into water and oxygen.
8	To partially purify an enzyme using salt precipitation.
9	To measure catalase activity in plant leaves.
10	To measure antioxidant activity using DPPH assay.

3rd semester
Genetics

School Name- School of Sciences			
Program- B.sc Biotechnology			**Semester-3rd**
Course Name- Genetics			
A.Y -2025-2026	**Course Code- B100524301**	**Batch-2024-2028**	**CIE Marks- 50 (MM)**
Total Teaching Hours- 45	**Total Credits-0-0-3**		**ESE Marks- 50 (MM)**
Type of Course- Theory			**Total Marks- 100 (MM)**

Course Objectives: Fundamental knowledge of genetics, inheritance, molecular mechanisms, mutations, gene regulation, population genetics, and applied biotechnology will be covered in the course, with a focus on their applications in forensics, medicine, agriculture, and ethical issues.

Course Description: This course explores fundamental genetic principles, including Mendelian and molecular genetics, chromosomal inheritance, gene mutations, and population genetics. It covers gene regulation, genetic engineering, and biotechnology applications in medicine, agriculture, and forensics. Emphasis is placed on genetic disorders, DNA fingerprinting, and ethical considerations in genetic research and counselling.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	**Unit 1: Introduction to Genetics and Mendelian Principles:** History and Scope of Genetics in Biotechnology**,** Mendel's Laws of Inheritance: Law of Segregation and Law of Independent Assortment**,** Monohybrid, Dihybrid, and Trihybrid Crosses**,** Extensions of Mendelian Genetics: Incomplete Dominance, Co-Dominance, Multiple Alleles**,** Gene Interactions: Epistasis, Complementary and Supplementary Genes	**8**
2	**Unit 2: Chromosomal Basis of Inheritance:** Structure and	**9**

	Organization of Chromosomes, Linkage and Crossing Over: Mechanisms and Significance, Chromosome Mapping and Genetic Linkage Maps, Sex Determination Mechanisms (XX-XY, ZZ-ZW, Haplo-Diploidy), Sex-Linked, Sex-Limited, and Sex-Influenced Traits.	
3	**Unit 3: Mutations and Genetic Variations:** Types of Mutations: Gene Mutations (Point, Frameshift) and Chromosomal Mutations (Deletion, Duplication, Inversion, Translocation), Causes of Mutations: Spontaneous and Induced Mutations, Mutagenic Agents: Physical, Chemical, and Biological Mutagens, DNA Repair Mechanisms, Role of Mutations in Evolution and Biotechnology.	**9**
4	**Unit 4: Molecular Genetics and Gene Regulation:** Structure and Function of DNA and RNA, DNA Replication: Mechanisms and Enzymes Involved, Transcription: RNA Synthesis, Processing, and Post-Transcriptional Modifications, Translation: Genetic Code, Protein Synthesis, and Post-Translational Modifications, Gene Regulation in Prokaryotes (Lac Operon) and Eukaryotes.	**9**
5	**Unit 5: Applied Genetics and Biotechnology:** Genetic Engineering: Recombinant DNA Technology and Gene Cloning, Applications of Genetics in Medicine and Agriculture, DNA Fingerprinting and Its Applications in Forensics, Human Genetic Disorders: Sickle Cell Anemia, Hemophilia, Down Syndrome, Ethical Issues in Genetics and Genetic Counseling.	**10**

Course Outcomes:

1. Understand Mendelian principles – Explain inheritance, gene interactions, and extensions.
2. Analyses chromosomal inheritance – Describe linkage, crossing over, and mapping.
3. Evaluate genetic mutations – Identify types, causes, and DNA repair mechanisms.
4. Comprehend molecular genetics – Explain replication, transcription, translation, and regulation.
5. Apply genetics in biotechnology – Explore genetic engineering, forensics, and medical

applications.

Text books:

1. Principles of Genetics" – By D. Peter Snustad and Michael J. Simmons
2. "Genetics: From Genes to Genomes" – By Leland H. Hartwell, Michael L. Goldberg, Janice A. Fischer, and Leroy Hood.

Reference books:

1. Genomes – by T.A. Brown (Focuses on genome structure, sequencing, and comparative genomics in modern genetics)
2. Principles of Genetics – by D. Peter Snustad and Michael J. Simmons (Comprehensive introduction to classical and molecular genetics)
3. Genetics: A Conceptual Approach – by Benjamin A. Pierce (Simplifies complex genetic concepts with clear explanations and illustrations)

Assessment method: (Continuous Internal Assessment = 50 %, Final Examination = 50%)

Bioinformatics

<table>
<tr><td colspan="4">School Name- School of Sciences</td></tr>
<tr><td colspan="3">Program- B.sc Biotechnology</td><td>Semester-3rd</td></tr>
<tr><td colspan="4">Course Name- Bioinformatics</td></tr>
<tr><td>A.Y -2025-2026</td><td>Course Code-B100524302</td><td>Batch-2024-2028</td><td>CIE Marks- 50 (MM)</td></tr>
<tr><td>Total Teaching Hours- 45</td><td colspan="2">Total Credits-0-0-3</td><td>ESE Marks- 50 (MM)</td></tr>
<tr><td colspan="3">Type of Course- Theory</td><td>Total Marks- 100(MM)</td></tr>
<tr><td colspan="4">Course Objectives: The Bioinformatics course aims to equip students with knowledge of biological databases, sequence alignment, genomics, proteomics, molecular modeling, and computational tools. It emphasizes applications in biotechnology, medicine, and agriculture, integrating artificial intelligence and machine learning for biological data analysis and research advancements.
Course Description: This Bioinformatics course covers biological databases, sequence analysis,</td></tr>
</table>

genomics, proteomics, and molecular modeling. It explores computational tools, artificial intelligence, and machine learning applications in biotechnology, medicine, and agriculture, providing students with essential skills for data analysis, drug discovery, and computational biology research.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	**Unit 1: Introduction to Bioinformatics:** Definition, Scope, and Importance of Bioinformatics**,** Role of Bioinformatics in Biotechnology and Life Sciences**,** Overview of Computational Biology and Its Applications**,** Introduction to Biological Databases**,** Role of Artificial Intelligence and Machine Learning in Bioinformatics.	**8**
2	**Unit 2: Biological Databases and Data Retrieval:** Types of Biological Databases: Primary, Secondary, and Specialized Databases**,** Nucleotide Sequence Databases: GenBank, EMBL, DDBJ**,** Protein Sequence Databases: UniProt, Swiss-Prot, TrEMBL**,** Structural Databases: Protein Data Bank (PDB), SCOP, CATH**,** Data Retrieval Tools: BLAST, FASTA, ENTREZ**.**	**9**
3	**Unit 3: Sequence Alignment and Phylogenetics:** Concept of Sequence Alignment: Local vs. Global Alignment**,** Pairwise Sequence Alignment: Needleman-Wunsch and Smith-Waterman Algorithms**,** Multiple Sequence Alignment (MSA): CLUSTALW, MUSCLE**,**Phylogenetic Tree Construction: Methods and Tools**,** Applications of Phylogenetics in Evolutionary Biology and Taxonomy.	**9**
4	**Unit 4: Genomics and Proteomics:** Genome Sequencing Techniques: Sanger Sequencing, Next-Generation Sequencing (NGS)**,** Comparative Genomics and Functional Genomics**,** Protein Structure Prediction and Molecular Modeling**,** Protein-Protein Interactions and Functional Annotation**,** Applications of Proteomics in Drug Discovery and Biotechnology**.**	**9**

5	**Unit 5: Structural Bioinformatics and Molecular Docking:** Molecular Structure Databases and Visualization Tools (RasMol, PyMOL), Basics of Molecular Docking and Drug Discovery, Homology Modeling and Computational Structure Prediction, Energy Minimization and Molecular Dynamics Simulation, Applications of Structural Bioinformatics in Biomedical Research.	**10**

Course Outcomes

1. Understand bioinformatics concepts and their applications in biotechnology and life sciences.
2. Retrieve and analyze biological data using various computational databases and tools.
3. Perform sequence alignment and construct phylogenetic trees for evolutionary studies.
4. Apply genomics and proteomics techniques in biotechnology and drug discovery.
5. Utilize molecular docking and bioinformatics tools for structural biology research.

Text books:

1. "Bioinformatics: Sequence and Genome Analysis" – David W. Mount
2. "Bioinformatics: Principles and Applications" – Zhumur Ghosh & Bibekanand Mallick.

Reference books:

1. Bioinformatics: Sequence and Genome Analysis – by David W. Mount (Comprehensive introduction to bioinformatics, sequence alignment, and genomics)
2. Bioinformatics: Concepts, Skills, and Applications – by S.C. Rastogi, Namita Mendiratta, and Parag Rastogi (Covers bioinformatics tools, databases, and applications in life sciences)
3. **Assessment method:** (Continuous Internal Assessment = 50 %, Final Examination = 50%)

Pharmaceutical Biotechnology

School Name- School of Sciences			
Program-B.sc Biotechnology			**Semester-3rd**
Course Name- Pharmaceutical Biotechnology			

A.Y -2025-2026	Course Code-B100524303	Batch-2024-2028	CIE Marks- 50 (MM)
Total Teaching Hours-45	Total Credits-0-0-3		ESE Marks- 50 (MM)
Type of Course- Theory			Total Marks-100.(MM)

Course Objective: The **Pharmaceutical Biotechnology** course aims to provide comprehensive knowledge of biopharmaceuticals, including drug development, gene therapy, monoclonal antibodies, vaccines, and recombinant proteins. It emphasizes biotechnological applications in medicine, regulatory aspects, and advancements in personalized medicine and targeted drug delivery systems.

Course Description: The **Pharmaceutical Biotechnology** course explores biotechnological applications in drug development, including biopharmaceuticals, gene therapy, monoclonal antibodies, and vaccines. It covers recombinant DNA technology, protein therapeutics, regulatory guidelines, and innovations in targeted drug delivery, emphasizing advancements in personalized medicine and biomedical research.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	**Unit 1: Introduction to Pharmaceutical Biotechnology:** Scope and Applications of Biotechnology in Pharmaceuticals**,** Historical Development of Pharmaceutical Biotechnology**,** Biotechnology-Based Drugs vs. Conventional Drugs**,** Role of Microorganisms in Pharmaceutical Industry**,** Good Manufacturing Practices (GMP) and Regulatory Aspects**,**	**8**
2	**Unit 2: Biopharmaceuticals and Drug Development:** Types of Biopharmaceuticals: Peptides, Proteins, and Monoclonal Antibodies**,** Recombinant DNA Technology in Drug Development**,** Expression Systems: Bacteria, Yeast, and Mammalian Cells**,** Biosimilars and Their Applications**,** Gene Therapy: Techniques, Applications, and Challenges**.**	**9**

3	**Unit 3: Enzymes and Fermentation Technology:** Industrial Enzymes Used in Pharmaceuticals (Amylases, Proteases, Lipases), Enzyme Immobilization and Its Applications, Microbial Fermentation: Batch, Fed-Batch, and Continuous Culture, Production of Antibiotics, Vaccines, and Therapeutic Proteins, Quality Control and Downstream Processing in Biopharmaceutical Production.	**9**
4	**Unit 4: Immunology and Vaccine Development:** Basics of Immunology: Antigens, Antibodies, and Immune Response, Hybridoma Technology and Monoclonal Antibody Production, Types of Vaccines: Live-Attenuated, Inactivated, Subunit, mRNA-Based, Recombinant Vaccines and DNA Vaccines, Vaccine Production and Quality Control.	**9**
5	**Unit 5: Pharmacogenomics and Personalized Medicine:** Concept of Pharmacogenomics and Its Role in Drug Development, Genetic Variability and Drug Response, Personalized Medicine: Applications and Challenges, CRISPR-Cas9 Technology in Drug Development, Ethical and Regulatory Aspects of Pharmacogenomics.	**10**

Course Outcomes:

1. Understand pharmaceutical biotechnology applications in drug development and manufacturing.
2. Explain recombinant DNA technology and biopharmaceutical production processes.
3. Analyze enzyme technology and fermentation in pharmaceutical industries.
4. Describe immunological principles and advancements in vaccine development.
5. Explore pharmacogenomics, personalized medicine, and gene-editing technologies.

Text books:

1. "Pharmaceutical Biotechnology: Fundamentals and Applications" – Daan J. A. Crommelin, Robert D. Sindelar, Bernd Meibohm
2. "Biopharmaceutics and Pharmacokinetics: A Treatise" – D. M. Brahmankar & Sunil B. Jaiswal.

Reference books:

1. Pharmaceutical Biotechnology – by S.P. Vyas and V.K. Dixit (Detailed coverage of drug delivery, monoclonal antibodies, and gene therapy).
2. Textbook of Biopharmaceutics and Pharmacokinetics – by Brahmankar and Jaiswal (Focuses on drug absorption, distribution, metabolism, and elimination in biotechnology-based drugs).
3. **Assessment method:** (Continuous Internal Assessment = 50 %, Final Examination = 50%)

Computational Biology and Drug Discovery

School Name- School of Sciences			
Program-B.sc Biotechnology			**Semester-3rd**
Course Name- Computational Biology and Drug Discovery			
A.Y -2025-2026	**Course Code-B100524304**	**Batch-2024-2028**	**CIE Marks- 50(MM)**
Total Teaching Hours- 45	**Total Credits-0-0-3**		**ESE Marks- 50 (MM)**
Type of Course- Theory			**Total Marks- 100 (MM)**

Course Objective: The objective of this course is to provide an understanding of computational biology techniques and their applications in drug discovery. Students will learn molecular modeling, bioinformatics tools, virtual screening, and structure-based drug design for developing novel therapeutics and optimizing drug efficacy.

Course Description: This course explores computational biology techniques in drug discovery, including molecular modeling, virtual screening, and bioinformatics tools. Students will learn structure-based drug design, pharmacokinetics, and computational approaches to identify potential drug candidates for various diseases, enhancing their skills in pharmaceutical research.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	**Unit 1: Introduction to Computational Biology and Drug Discovery:** Definition, Scope, and Importance of Computational Biology, Role of Computational Biology in Modern Biotechnology, Basics of Drug	8

	Discovery and Development Process, Bioinformatics in Drug Discovery: An Overview, Key Computational Approaches in Drug Research.	
2	**Unit 2: Biological Databases and Sequence Analysis:** Introduction to Biological Databases (NCBI, EMBL, DDBJ, UniProt, PDB), Nucleotide and Protein Sequence Databases, Data Retrieval Tools: BLAST, FASTA, ENTREZ, Genome and Proteome Databases for Drug Discovery, Applications of Sequence Analysis in Drug Target Identification.	**9**
3	**Unit 3: Molecular Modeling and Docking,** Basics of Molecular Modeling and Its Applications, 3D Structure Prediction of Biomolecules, Molecular Docking: Definition, Types, and Importance, Ligand-Protein Interaction and Drug-Target Binding, Software for Molecular Modeling and Docking (PyMOL, AutoDock).	**9**
4	**Unit 4: Drug Design and Pharmacoinformatics:** Basics of Drug Design: Target-Based and Ligand-Based Approaches, High-Throughput Screening (HTS) and Virtual Screening, Structure-Based Drug Design (SBDD) vs. Ligand-Based Drug Design (LBDD), Pharmacophore Modeling and Its Role in Drug Discovery, QSAR (Quantitative Structure-Activity Relationship) Studies.	**10**
5	**Unit 5: ADMET and Toxicity Prediction,** Concept of ADMET (Absorption, Distribution, Metabolism, Excretion, and Toxicity), In Silico Prediction of Drug Pharmacokinetics, Computational Tools for Drug Toxicity Assessment, Importance of Drug Safety and Risk Assessment, Case Studies on Drug Failure Due to Toxicity.	**9**

Course Outcomes:

1. Understand computational biology's role in modern drug discovery processes.
2. Utilize biological databases for drug target identification and analysis.

3. Apply molecular modeling and docking techniques in drug research.
4. Analyze pharmacophore modeling and QSAR for drug design.
5. Assess ADMET properties and toxicity using computational tools.

Text Books:

1. "Computational Drug Discovery and Design" – Riccardo Baron
2. "Bioinformatics and Drug Discovery" – Richard S. Larson

Reference Books:

1. Computational Drug Discovery and Design – by Riccardo Baron (Covers molecular modeling, docking, and computational techniques in drug discovery).
2. Bioinformatics and Drug Discovery – by Richard S. Larson (Explores bioinformatics tools and their applications in drug development.)
3. Molecular Modeling and Drug Design – by K. Anand Solomon (Focuses on computer-aided drug design, molecular docking, and QSAR studies).

Assessment method: (Continuous Internal Assessment = 50 %, Final Examination = 50%)

Public Health Biology

School Name- School of Sciences			
Program- B.sc Biotechnology			**Semester-3rd**
Course Name- Public Health Biology			
A.Y -2025-2026	**Course Code-B10GE2403**	**Batch-2024-2028**	**CIE Marks- 50 (MM)**
Total Teaching Hours-45	**Total Credits-0-0-3**		**ESE Marks- 50 (MM)**
Type of Course- Theory			**Total Marks- 100 (MM)**

Course Objective: The objective of the Public Health Biology course is to provide an understanding of biological principles in public health, covering infectious and non-communicable diseases, immunology, epidemiology, environmental health, genomics, and biotechnology applications for disease prevention, diagnostics, and public health interventions.

Course Description: This course explores the biological foundations of public health, covering infectious and non-communicable diseases, immunology, epidemiology, environmental health, and public health genomics. It emphasizes biotechnology applications in disease prevention, diagnostics, and surveillance, addressing emerging health challenges and ethical considerations in public health biology.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	**Unit 1: Introduction to Public Health Biology:** Definition and Scope of Public Health Biology, Relationship between Biology and Public Health, Concepts of Health and Disease: Infectious vs. Non-Communicable Diseases, Epidemiology: Basic Principles and Applications, Role of Biotechnology in Public Health.	**8**
2	**Unit 2: Infectious Diseases and Immunology:** Pathogens and Disease Transmission (Bacteria, Viruses, Fungi, Parasites), Emerging and Re-Emerging Infectious Diseases (COVID-19, Tuberculosis, HIV/AIDS), Basics of Immunology: Innate and Adaptive Immunity, Vaccine Development and Immunization Programs, Antimicrobial Resistance and Public Health Concerns.	**9**
3	**Unit 3: Non-Communicable Diseases (NCDs) and Lifestyle Disorders:** Major Non-Communicable Diseases: Diabetes, Cardiovascular Diseases, Cancer, Genetic and Environmental Factors in NCDs, Role of Nutrition and Lifestyle in Disease Prevention, Public Health Interventions for NCD Control, Role of Biotechnology in Personalized Medicine.	**9**
4	**Unit 4: Environmental and Occupational Health:** Impact of Pollution on Human Health (Air, Water, and Soil Contaminants), Climate Change and Public Health (Heatwaves, Vector-Borne Diseases), Occupational Hazards and Workplace Health Safety, Water Sanitation and Hygiene (WASH) in Disease Prevention, Public Health	**9**

	Strategies for Environmental Risk Management.	
5	**Unit 5: Public Health Genomics and Biotechnology Applications;** Basics of Public Health Genomics and Genetic Screening, Role of Biotechnology in Disease Diagnostics (PCR, ELISA, Biosensors), Genomic Epidemiology and Disease Surveillance, Role of Microbiome in Human Health and Disease, Ethical and Social Issues in Public Health Genomics.	**10**

Course Outcomes

1. Explain the relationship between biology and public health applications effectively.
2. Analyze infectious and non-communicable diseases with epidemiological principles.
3. Evaluate environmental and occupational health impacts on human well-being.
4. Assess biotechnology's role in disease diagnostics and public health genomics.
5. Discuss ethical and social issues in public health biotechnology.

Text Books:

1. "Public Health Biology: The Science of Health Promotion" – William H. Markle, Melissa A. Book, and Melanie Fisher
2. "Public Health: What It Is and How It Works" – Bernard J. Turnock.

Reference Books:

1. Public Health Biology: The Science of Health – by Robert H. Friis (Explores the biological basis of public health, including disease prevention and epidemiology.).
2. Introduction to Public Health Biology: A Biosocial Approach – by Michael V. Kohn (Covers infectious diseases, genetics, and environmental health from a public health perspective.).

Assessment method: (Continuous Internal Assessment = 50 %, Final Examination = 50%)

Research Writing Skills

School Name- School of Sciences			
Program-B.sc biotechnology			**Semester-3rd**
Course Name- Research Writing Skills			
A.Y -2025-2026	**Course Code- BSGUAE2405**	**Batch-2024-2028**	**CIE Marks- 50 (MM)**
Total Teaching Hours- 30	**Total Credits-0-0-2**		**ESE Marks- 50 (MM)**
Type of Course- Theory			**Total Marks- 100 .(MM)**

Course Objective: The **Research Writing Skills** course aims to develop students' ability to write clear, concise, and well-structured research papers. It covers academic writing styles, literature review techniques, citation methods, data presentation, and ethical considerations, enhancing scholarly communication and critical thinking skills.

Course Description: The **Research Writing Skills** course provides essential techniques for effective academic writing, including structuring research papers, conducting literature reviews, citing sources, and presenting data. It emphasizes clarity, coherence, ethical writing practices, and critical thinking to enhance students' scholarly communication and publication skills.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	**Unit 1: Introduction to Research Writing:** Understanding Research: Definition, Importance, and Types, Fundamentals of Scientific Writing and Communication, Structure of a Research Paper: IMRAD Format (Introduction, Methods, Results, and Discussion), Ethics in Research and Academic Integrity, Plagiarism, Types, Consequences, and Avoidance.	**5**
2	**Unit 2: Literature Review and Referencing:** Importance of Literature Review in Research Writing, Techniques for Searching Scientific Literature (Google Scholar, PubMed, Scopus), Organizing and Summarizing Literature, Citation Styles: APA, MLA, Chicago, Harvard,	7

	and Vancouver, Reference Management Tools (Mendeley, EndNote, Zotero).	
3	**Unit 3: Writing Research Proposals and Abstracts:** Components of a Research Proposal, Identifying Research Problems and Formulating Objectives, Writing Effective Abstracts and Summaries, Common Mistakes in Proposal Writing, Reviewing and Revising Proposals.	6
4	**Unit 4: Data Presentation and Scientific Writing Techniques:** Presenting Data Effectively: Tables, Figures, and Graphs, Writing Results and Discussions in Research Papers, Writing Clear and Concise Scientific Arguments, Formatting and Proofreading Scientific Documents, Role of AI and Software in Research Writing	6
5	**Unit 5: Writing and Publishing Research Papers:** Steps in Writing a Research Manuscript, Selecting the Right Journal for Publication, Peer Review Process and Responding to Reviewer Comments, Understanding Open Access and Predatory Journals, Ethical Issues in Publishing (Duplicate Submission, Data Fabrication).	6

Course Outcomes

1. Understand research fundamentals and ethical writing practices in academia.
2. Conduct literature reviews and manage citations using reference tools.
3. Develop research proposals and write concise, impactful abstracts.
4. Present data effectively and apply scientific writing techniques.
5. Prepare, submit, and publish research papers ethically and professionally.

Text Books:

1. "Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded" – Joshua Schimel
2. "The Craft of Research" – Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams

Reference Books:

1. Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded – by Joshua Schimel (Focuses on effective scientific writing and grant proposal strategies.).

2. The Craft of Research – by Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams (Comprehensive guide on research methodology and academic writing.).

Assessment method: (Continuous Internal Assessment = 50 %, Final Examination = 50%)

Practicals
Genetics

School Name- School of Sciences			
Program-B.sc Biotechnology			**Semester-3rd**
Course Name- Genetics			
A.Y-2025-2026	**Course Code- B100524351P**	**Batch-2024-2028**	**CIE Marks- 60 (MM)**
Total Teaching Hours- 15	**Total Credits- 0-0-1**		**ESE Marks-40 (MM)**
Type of Course- Practical			**Total Marks-100 (MM)**

S.No.	Topic
1	Study of Monohybrid and Dihybrid Crosses Using Corn or Pea Seeds
2	Blood Group Testing for ABO and Rh Factor (Multiple Allelism & Co-Dominance)
3	Pedigree Analysis of Human Genetic Disorders (Sickle Cell Anemia, Hemophilia, etc.)
4	Chromosomal Aberrations Study Using Prepared Slides (Deletion, Inversion, Translocation, etc.)
5	DNA Extraction from Plant/Animal/Bacterial Cells
6	Study of Epistasis Using Colored Corn Kernels or Drosophila (Fruit Fly) Models

7	Agarose Gel Electrophoresis for DNA Fragment Analysis
8	Polymerase Chain Reaction (PCR) for Gene Amplification.

Bioinformatics Practical

School Name- School of Sciences			
Program- B.sc Biotechnology			**Semester-3rd**
Course Name- Bioinformatics			
A.Y-2025-2026	**Course Code- B100524352P**	**Batch-2024-2028**	**CIE Marks- 60 (MM)**
Total Teaching Hours-15	**Total Credits- 0-0-1**		**ESE Marks-40 (MM)**
Type of Course- Practical			**Total Marks-100 (MM)**

S.no.	**Topics**
1	Introduction to Bioinformatics.
2	Retrieval of Nucleotide sequence from GenBank.
3	Retrieval of Protein sequence from GenBank.
4	Sequence Similarity Search using BLASTN.
5	Sequence Similarity Search using BLASTP.
6	Accessing Structural Database and Download the Protein Structure

7	Predicting Peptide mass of protein sequence
8	Predicting cleavage site of protein sequence.
9	Conversion of nucleotide sequence into Protein sequence.

4th semester

Bioprocess Engineering

School Name- School of Sciences			
Program- B.sc Biotechnology			**Semester-4th**
Course Name- Bioprocess Engineering			
A.Y-2025-2026	**Course Code-B100524401**	**Batch- 2024-2028**	**CIE Marks-50 (MM)**
Total Teaching Hours-45	**Total Credits-0-0-3**		**ESE Marks- 50 (MM)**
Type of Course- Theory			**Total Marks-100 (MM)**

Course Objective: This course aims to provide fundamental knowledge of bioprocess engineering, covering microbial growth, bioreactor design, fermentation technology, downstream processing, and bioproduct recovery. It emphasizes the application of biochemical and engineering principles in industrial biotechnology for sustainable bioprocess development.

Course Description: This course explores the principles of bioprocess engineering, including microbial kinetics, bioreactor operations, fermentation technology, and downstream processing. It emphasizes industrial applications in pharmaceuticals, food, and biofuels, integrating biochemical and engineering concepts for efficient bioproduct development and large-scale production.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	***Unit 1: Introduction to Bioprocess Engineering:*** *Definition, Scope, and Importance of Bioprocess Engineering, Basic Concepts of Microbial, Animal, and Plant Cell Culture in Bioprocessing, Overview of Industrial Bioprocesses (Fermentation, Enzyme Technology, Biofuels, Biopharmaceuticals), Role of Bioprocess Engineering in Biotechnology and Bioeconomy, Principles of Mass and Energy Balance*	9

	in Bioprocesses.	
2	**Unit 2: Bioreactors and Fermentation Technology:** Types of Bioreactors: Stirred Tank, Airlift, Packed Bed, and Fluidized Bed Reactors**,** Batch, Fed-Batch, and Continuous Fermentation Processes**,** Design and Control of Bioreactors: Agitation, Aeration, pH, Temperature, and Oxygen Transfer**,** Scale-Up and Scale-Down of Bioprocesses, Sterilization of Bioreactors and Media.	**10**
3	**Unit 3: Microbial Growth Kinetics and Metabolism:** Microbial Growth Phases and Kinetics (Monod Equation, Yield Coefficients)**,** Environmental Factors Affecting Microbial Growth**,** Primary and Secondary Metabolites in Bioprocessing**,** Bioconversions and Biotransformations**,** Metabolic Engineering for Enhanced Product Formation**.**	**9**
4	**Unit 4: Downstream Processing and Product Recovery:** Principles of Downstream Processing in Bioprocess Engineering**,** Cell Disruption Methods (Mechanical and Non-Mechanical)**,** Separation Techniques: Filtration, Centrifugation, and Chromatography**,** Purification and Formulation of Bioproducts**,** Quality Control and Regulatory Aspects of Bioprocessed Products**.**	**10**
5	**Unit 5: Enzyme Technology and Biocatalysis:** Basics of Enzyme Kinetics and Immobilization Techniques**,** Enzyme Production, Purification, and Applications in Industry**,** Biocatalysis in Pharmaceuticals, Food, and Environmental Biotechnology**,** Industrial Applications of Recombinant Enzymes**,** Enzyme Engineering and Protein Engineering for Improved Functionality.	**7**

Course Outcomes

1. Explain bioprocess engineering principles and their role in biotechnology.
2. Demonstrate knowledge of bioreactors and fermentation process optimization.

3. Analyze microbial growth kinetics and metabolic pathways in bioprocesses.
4. Apply downstream processing techniques for bioproduct recovery and purification.
5. Utilize enzyme technology for industrial and pharmaceutical biocatalysis applications.

Text Books:

1. Bioprocess Engineering: Basic Concepts – Michael L. Shuler, Fikret Kargi
2. Bioprocess Engineering Principles – Pauline M. Doran.
3. Handbook of Industrial Bioprocessing – Shrikrishna N. Joshi

Reference Books:

1. Principles of Fermentation Technology – Peter F. Stanbury, Allan Whitaker, Stephen J. Hall
2. Biochemical Engineering Fundamentals – James E. Bailey, David F. Ollis

Assessment method: (Continuous Internal Assessment = 50%, Final Examination = 50%).

Cell Tissue Culture Technology

School Name- School of Sciences			
Program-B.sc Biotechnology			**Semester-4th**
Course Name- Cell Tissue Culture Technology			
A.Y-2025-2026	**Course Code-B100524402**	**Batch-2024-2028**	**CIE Marks-50 (MM)**
Total Teaching Hours-45	**Total Credits-0-0-3**		**ESE Marks- 50 (MM)**
Type of Course- Theory			**Total Marks-100 (MM)**

Course Objective: This course aims to provide fundamental knowledge and practical skills in cell culture techniques, including aseptic handling, media preparation, subculturing, cryopreservation, and advanced applications in biotechnology, drug development, and regenerative medicine, while emphasizing biosafety, quality control, and regulatory guidelines.

Course Description: The course covers basic cell culture principles, media composition, growth conditions, cell maintenance, and specialized techniques like 3D culture, transfection, and hybridoma technology. It explores applications in monoclonal antibody production, vaccine development, recombinant protein expression, and drug screening while ensuring biosafety compliance.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	**Unit 1: Introduction to Cell Culture**: **Definition and Importance of Cell Culture, Historical Background of Cell Culture,Types of Cell Cultures: Primary, Secondary, and Continuous Cell Lines, Basic Laboratory Requirements and Biosafety in Cell Culture, Aseptic Techniques and Contamination Control.**	9
2	Unit 2: Cell Culture Media and Growth Conditions: **Types of Culture Media: Natural vs. Synthetic Media, Components of Culture Media: Amino Acids, Vitamins, Salts, Serum, Antibiotics, Serum-Free and Chemically Defined Media, Factors Affecting Cell Growth: Temperature, pH, CO_2 Concentration, Oxygen Levels, Preparation, Filtration, and Sterilization of Culture Media.**	**10**
3	Unit 3: Cell Growth, Subculture, and Maintenance: **Cell Growth Phases and Doubling Time, Trypsinization and Subculturing (Passaging Cells), Cryopreservation and Thawing of Cells, Cell Counting Techniques: Hemocytometer, Automated Cell Counters, Cell Viability Assays: Trypan Blue Exclusion, MTT Assay.**	**9**
4	Unit 4: Specialized Cell Culture Techniques: **3D Cell Culture and Spheroid Formation, Co-Culture Systems: Mixed and Conditioned Culture Methods, Stem Cell Culture and Differentiation Techniques, Organotypic and Tissue Engineering Approaches, Use of Micro carriers in Large-Scale Cell Culture.**	**10**
5	Unit 5: Advanced Cell Culture and Quality Control: **Good Laboratory Practices (GLP) in Cell Culture, Biosafety Levels (BSL-1 to BSL-4) and Their Applications, Mycoplasma Detection and Contamination Control Strategies, Regulatory Guidelines for Cell Culture-Based**	**7**

	Products (FDA, ICMR, WHO), Future Trends: Organoids, Lab-on-a-Chip, and Artificial Organs.	

Course Outcomes

1. Understand fundamental concepts and techniques of cell culture and biosafety.
2. Analyze media components, growth conditions, and factors influencing cell viability.
3. Perform cell growth, Subculturing, and cryopreservation techniques efficiently.
4. Apply advanced cell culture methods for biotechnology and medical applications.
5. Evaluate regulatory guidelines, contamination control, and emerging cell culture technologies.

Text Books:

1. Human Cell Culture Protocols – Ragai R. Mitry, Anil Dhawan
2. Plant Tissue Culture: Techniques and Experiments – Roberta H. Smith

Reference Books:

1. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications – R. Ian Freshney
2. Animal Cell Culture: A Practical Approach – John M. Davis
3. Basic Cell Culture Protocols – Cheryl D. Helgason, Cindy L. Miller

Assessment method: (Continuous Internal Assessment = 50%, Final Examination = 50%).

Recombinant DNA technology

School Name- School of Sciences			
Program- B.sc Biotechnology			**Semester-4th**
Course Name- Recombinant DNA technology			
A.Y-2025-2026	**Course Code-B100524403**	**Batch-2024-2024**	**CIE Marks-50 (MM)**
Total Teaching Hours-45	**Total Credits-0-0-3**		**ESE Marks- 50 (MM)**
Type of Course- Theory			**Total Marks-100 (MM)**

Course Objective: The objective of the **Recombinant DNA Technology** course is to provide fundamental knowledge of genetic engineering principles, gene cloning techniques, vector systems, PCR, gene expression, and applications in biotechnology, medicine, and agriculture, ensuring ethical and regulatory compliance in genetic manipulation and therapeutic advancements.

Course Description: The **Recombinant DNA Technology** course covers gene cloning, vector systems, PCR, genome editing, and expression analysis. It explores applications in biotechnology, medicine, and agriculture while addressing ethical, safety, and regulatory aspects of genetic manipulation for research and industrial advancements.

UNIT-1	**Topics**	**No. of Teaching hours/ (Lecture)**
1	Unit 1: Introduction to Recombinant DNA Technology: **History and Scope of rDNA Technology, Basic Principles of Genetic Engineering, Enzymes Used in rDNA Technology :(Restriction Endonucleases, DNA Ligases, Polymerases (Taq DNA Polymerase, Reverse Transcriptase), Alkaline Phosphatase and Kinases, Steps Involved in rDNA Technology, Applications of Genetic Engineering in Medicine, Agriculture, and Industry.**	9
2	Unit 2: Vectors for Gene Cloning: **Types of Cloning Vectors:, Plasmids (pBR322, pUC Series), Bacteriophages (λ Phage Vectors), Cosmids and Phagemids, Yeast Artificial Chromosomes (YACs) and Bacterial Artificial Chromosomes (BACs), Viral Vectors (Adenovirus, Retrovirus, Lentivirus), Expression Vectors vs. Cloning Vectors, Selection Markers and Reporter Genes (LacZ, GFP, Antibiotic Resistance Genes), Promoters and Regulatory Elements in Expression Vectors.**	**10**
3	Unit 3: Gene Cloning and Transformation Techniques: **Isolation of DNA and RNA from Various Sources, Construction of Recombinant DNA Molecules, Methods of Gene Insertion into Vectors: Restriction-Ligation**	**9**

	Cloning, TA Cloning and Gibson Assembly, Gateway Cloning and CRISPR-Based Cloning, Transformation and Transfection Techniques: **Heat Shock and Electroporation (Bacteria), Liposome-Mediated and Calcium Phosphate Transfection (Mammalian Cells), Microinjection and Biolistics (Gene Gun).**	
4	Unit 4: Screening and Selection of Recombinant Clones: **Selection of Recombinants Using Selectable Markers, Screening Techniques: Blue-White Screening (LacZ Selection), Colony PCR and Restriction Digestion Analysis, Southern and Northern Blotting Techniques, Fluorescent and Luminescent Reporter Assays, Quantification of Gene Expression (qPCR, RT-PCR, Microarrays).**	**10**
5	Unit 5: Applications of Recombinant DNA Technology: **Production of Recombinant Proteins (Insulin, Growth Hormones, Vaccines), Genetic Engineering in Agriculture: Genetically Modified Crops (Bt Cotton, Golden Rice), Herbicide-Resistant and Pest-Resistant Crops, Gene Therapy and Personalized Medicine, DNA Fingerprinting and Forensic Applications, Biopharmaceuticals and Industrial Enzyme Production.**	**7**

Course Outcomes

1. Explain principles and enzymes used in recombinant DNA technology.
2. Describe cloning vectors, selection markers, and gene expression systems.
3. Demonstrate gene cloning, transformation, and transfection techniques.
4. Analyze screening, selection, and quantification methods for recombinant clones.
5. Apply rDNA technology in medicine, agriculture, and industrial biotechnology.

Text Books:

1. Genetic Engineering: Principles and Methods – Jane K. Setlow.
2. Recombinant DNA Technology – Keya Chaudhuri

Reference Books:

1. Molecular Cloning: A Laboratory Manual – Michael R. Green, Joseph Sambrook.
2. Principles of Gene Manipulation and Genomics – Sandy B. Primrose, Richard Twyman.

Assessment method: (Continuous Internal Assessment = 50%, Final Examination = 50%)

Microbial Technology

School Name- School of Sciences			
Program- B.sc Biotechnology			**Semester-4th**
Course Name- Microbial Technology			
A.Y-2025-2026	**Course Code-B100524404**	**Batch-2024-2028**	**CIE Marks-50 (MM)**
Total Teaching Hours-45	**Total Credits-0-0-3**		**ESE Marks- 50 (MM)**
Type of Course- Theory			**Total Marks-100 (MM)**

Course Objective: This course provides fundamental knowledge of microbial technology, including microbial cultivation, metabolic pathways, industrial applications, and genetic engineering. It emphasizes microbial biotechnology in pharmaceuticals, agriculture, and environmental sectors, focusing on fermentation, bioprocessing, enzyme technology, and bio-product development for sustainable solutions.

Course Description: Microbial Technology explores microbial physiology, genetics, and industrial applications. Topics include fermentation, enzyme production, biofuels, probiotics, and bioremediation. Emphasis is placed on microbial biotechnology in healthcare, agriculture, and industry, integrating genetic engineering, metabolic engineering, and bioprocessing techniques for innovative microbial applications.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	Unit 1: Introduction to Microbial Technology: **Scope and Importance of Microbial Technology, Diversity of Microorganisms Used in Biotechnology (Bacteria, Fungi, Viruses, and Archaea), Microbial Metabolism and Growth Kinetics, Culture Media and Conditions for**	9

	Microbial Growth, Methods for Microbial Isolation and Identification.	
2	Unit 2: Industrial Microbiology and Fermentation Technology: **Microbial Strain Improvement and Selection, Types of Fermentation: Batch, Continuous, and Fed-Batch Fermentation, Fermenter Design and Bioreactor Types (Stirred Tank, Airlift, Packed Bed, Fluidized Bed Reactors). Downstream Processing: Product Recovery and Purification, Quality Control in Industrial Microbial Processes.**	**10**
3	Unit 3: Microbial Enzymes and Their Applications, **Production and Purification of Microbial Enzymes, Types of Industrially Important Enzymes (Amylase, Protease, Lipase, Cellulase, Pectinase, Laccase), Enzyme Immobilization Techniques, Applications of Microbial Enzymes in Food, Textile, and Pharmaceutical Industries, Recent Advances in Enzyme Technology (CRISPR-based Enzyme Engineering, Metagenomics Approaches).**	**9**
4	Unit 4: Microbes in Agriculture and Environment: **Microbial Bio fertilizers (Rhizobium, Azotobacter, Azospirillum, Mycorrhizae, And Cyanobacteria), Biopesticides and Their Role in Sustainable Agriculture, Microbial Degradation and Bioremediation of Pollutants, Microbial Bioleaching and Biomining (Gold, Copper, Uranium Extraction), Role of Microbes in Wastewater Treatment and Solid Waste Management.**	**10**
5	Unit 5: Medical and Pharmaceutical Microbiology: **Production of Antibiotics (Penicillin, Streptomycin, Tetracycline, Erythromycin), Microbial Production of Vaccines and Recombinant Therapeutics, Probiotics and Prebiotics: Role in Human Health, Microbial Diagnostics**	**7**

	and Biosensors, Microbial Pathogenesis and Disease Control Strategies.	

Course Outcomes

1. Understand microbial diversity and growth for industrial and biotechnological applications.
2. Apply fermentation techniques for microbial product development and purification.
3. Utilize microbial enzymes in food, pharmaceuticals, and environmental industries.
4. Explore microbial roles in agriculture, bioremediation, and waste management.
5. Analyze microbial applications in pharmaceuticals, diagnostics, and disease control.

Text Books:

1. Microbial Biotechnology: Principles and Applications – Yuan Kun Lee
2. Biotechnology of Microbial Enzymes: Production, Biocatalysis, and Industrial Applications – Goutam Brahmachari.

Reference Books:

1. Microbial Biotechnology: Fundamentals of Applied Microbiology – Alexander N. Glazer, Hiroshi Nikaido
2. Industrial Microbiology and Biotechnology – Michael J. Waites, Neil L. Morgan, John S. Rockey, Gary Higton

Assessment method: (Continuous Internal Assessment = 50%, Final Examination = 50%)

Information Technology for Biologists

School Name- School of Sciences			
Program- B.sc Biotechnology			**Semester-4th**
Course Name- Information Technology for Biologists			
A.Y-2025-2026	**Course Code-B100524405**	**Batch-2024-2028**	**CIE Marks-50 (MM)**
Total Teaching Hours- 45	**Total Credits-0-0-3**		**ESE Marks- 50 (MM)**
Type of Course- Theory			**Total Marks-100 (MM)**

Course Objective: This course introduces biologists to fundamental information technology concepts, including bioinformatics, data management, computational tools, and biological databases. It aims to enhance analytical skills in genomics, proteomics, and systems biology using software, programming, and AI-driven approaches for biological research and innovation.

Course Description: Information Technology for Biologists explores computational techniques, database management, and bioinformatics tools essential for biological data analysis. Topics include sequence alignment, molecular modelling, big data analytics, and AI applications in biology. This course equips students with IT skills for modern biological research.

UNIT-1	Topics	No. of Teaching hours/ (Lecture)
1	Unit 1: Fundamentals of Information Technology in Biology: **Introduction to IT and Its Role in Biology, Basic Concepts of Computers: Hardware and Software, Operating Systems (Windows, Linux) and Their Use in Scientific Research, Introduction to Programming Languages for Biologists (Python, R, Perl), Data Storage and Management in Biological Sciences**	9
2	Unit 2: Biological Databases and Data Retrieval: **Types of Biological Databases: Primary, Secondary, and Specialized, Nucleotide Sequence Databases (GenBank, EMBL, DDBJ), Protein Sequence Databases (UniProt, Swiss-Prot, TrEMBL), Structural Databases (Protein Data Bank - PDB, SCOP, CATH), Data Retrieval Tools: BLAST, FASTA, ENTREZ, PubMed.**	**10**
3	Unit 3: Computational Tools for Biological Data Analysis: **Sequence Alignment: Local vs. Global Alignment, Pairwise Alignment (Needleman-Wunsch and Smith-Waterman Algorithms), Multiple Sequence Alignment (CLUSTALW, MUSCLE), Phylogenetic Analysis and Tree Construction Methods, Gene Prediction and Annotation Tools (Genscan, AUGUSTUS).**	**9**

4	Unit 4: Bioinformatics Software and Applications: **Introduction to Bioinformatics Tools (Bio Perl, Bio Python, R for Bioinformatics), Molecular Visualization Tools (RasMol, PyMOL, Chimera), Protein Structure Prediction and Molecular Docking (AutoDock, SwissDock), Genome Sequencing Technologies and Data Processing, Use of Artificial Intelligence and Machine Learning in Bioinformatics.**	**10**
5	Unit 5: Big Data and Computational Biology: **Introduction to Big Data in Biology and Omics Sciences, Next-Generation Sequencing (NGS) Data Analysis, Systems Biology and Network Analysis, Metabolic Pathway Analysis and KEGG Pathways, Cloud Computing and High-Performance Computing (HPC) in Biological Research.**	**7**

Course Outcomes

1. Apply computational tools for biological data analysis and interpretation.
2. Utilize bioinformatics databases for genomics and proteomics research applications.
3. Analyze biological sequences using programming and algorithmic approaches.
4. Implement AI and machine learning in biological data processing.
5. Manage and visualize large-scale biological datasets effectively.

Text Books:

1. Bioinformatics: Sequence and Genome Analysis – David W. Mount
2. Computational Biology and Bioinformatics: Gene Regulation – Ka-Chun Wong

Reference Books:

1. Biological Data Analysis: A Practical Approach – Jeremy J. Ramsden
2. Introduction to Bioinformatics – Arthur M. Lesk
3. Biocomputing: Informatics and Genome Projects – Douglas W. Smith.

Assessment method: (Continuous Internal Assessment = 50%, Final Examination = 50%)

Practical's

Bioprocess Engineering practical

School Name- School of Sciences			
Program- B.sc Biotechnology			**Semester-4th**
Course Name- Bioprocess Engineering practical			
A.Y-2025-2026	**Course Code-B100524451P**	**Batch-2024-2028**	**CIE Marks- 60 (MM)**
Total Teaching Hours 30	**Total Credits-0-0-1**		**ESE Marks-40 (MM)**
Type of Course- Practical			**Total Marks-100(MM)**

S.no.	Topics
1	Study of Batch, Fed-Batch, and Continuous Fermentation Processes.
2	Determination of Microbial Growth Kinetics (μ, Yx/s).
3	Sterilization Techniques: Steam and Filtration Methods.
4	Media Preparation and Optimization for Microbial Growth.
5	Operation and Calibration of Bioreactor.
6	Downstream Processing: Cell Harvesting by Centrifugation.
7	Protein Precipitation and Dialysis Techniques.
8	Enzyme Assay and Activity Determination.
9	Oxygen Transfer Rate (OTR) and kLa Measurement in Fermentation Systems.
10	Biomass Estimation by Dry Weight and Optical Density Methods.

Cell culture techniques practical

School Name- School of Sciences			
Program- B.sc Biotechnology			**Semester-4th**
Course Name- Cell and Tissue Culture Technology Practical			
A.Y-2025-2026	**Course Code-B100524452P**	**Batch-2024-2028**	**CIE Marks-60 (MM)**
Total Teaching Hours-30	**Total Credits-0-0-1**		**ESE Marks-40(MM)**
Type of Course- Practical			**Total Marks-100(MM)**

S.no.	Topics
1	Preparation and Sterilization of Culture Media.
2	Aseptic Techniques in Cell Culture.
3	Subculturing and Maintenance of Adherent Cell Lines.
4	Cell Counting Using Hemocytometer and Viability Assay (Trypan Blue Exclusion).
5	Cryopreservation and Thawing of Cell Lines.
6	Growth Curve Analysis of Cultured Cells.
7	Cytotoxicity Assay (MTT or Trypan Blue Assay).
8	Observation of Morphology under Inverted Microscope.
9	Contamination Detection in Cell Cultures.
10	Transfection of Cultured Cells Using Chemical or Physical Methods.

Recombinant DNA technology Practical

School Name-School of sciences			
Program- B.sc Biotechnology			**Semester-4th**
Course Name- Recombinant DNA technology Practical			
A.Y-2025-2026	**Course Code-B100524453P**	**Batch-2024-2028**	**CIE Marks-60 (MM)**
Total Teaching Hours-30	**Total Credits-0-0-1**		**ESE Marks-40 (MM)**
Type of Course- Practical			**Total Marks-100(MM)**

S.no.	Topics
1	Isolation of Genomic DNA from Plant/Animal/Bacterial Cells.
2	Plasmid DNA Isolation from Bacterial Cells.
3	Quantification and Purity Check of DNA Using Spectrophotometry.
4	Restriction Digestion of DNA.
5	Ligation of DNA Fragments Using T4 DNA Ligase.
6	Competent Cell Preparation (Calcium Chloride Method).
7	Transformation of Competent Cells with Recombinant Plasmid.
8	Screening of Transformants Using Blue-White Selection.
9	Polymerase Chain Reaction (PCR) for Gene Amplification.
10	Agarose Gel Electrophoresis for DNA Fragment Analysis.