PT. RAVISHANKAR SHUKLA UNIVERSITY

Center for Basic Sciences

CURRICULUM & SYLLABI
[Based on LOCF]

Five Year Integrated M.Sc. (Zoology Stream)
(Semester System)

Session: 2024-25 & onwards

Approved by:	Board of Studies Zoology	Academic Council
Date: 9.7.2024.		

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PT. RAVISHANKAR SHUKLA UNIVERSITY
RAIPUR, CHHATTISGARH

Center for Basic Sciences

Objectives

The CBS model of education is concept-based and inquiry-driven, as opposed to the more traditional content-based models. There is a strong emphasis on the interdisciplinary natureof today's science, and recognition of the importance of research experience in undergraduate education.

Courses offered in the Int. M. Sc. program at CBS form part of a comprehensive program that will enable the students-

- To understand the basic laws of nature and develop necessary skills to apply them to any desired area or discipline.
- To undertake projects to solve field base problems.
- To provide student centric learning facilities for the development of overall personality of learner. The program is planned as student-centric collaborative learning.
- Students get trained for a career in basic sciences or any related applied science or technology.

Integrated Master of Science in Zoology

Courses offered during the first year (Semesters I to II) are meant as basic and introductory courses in Biology (Botany and Zoology), Chemistry, Mathematics, Physics and Environmental Science. These are common and mandatory for all students. These courses are intended to give a flavour of the various approaches and analyses and to prepare the students for advanced courses in later years of study. In addition, there will be Interdisciplinary Courses for computational skills and mathematical methods. Students are also given training to develop skills in Communication, Creative & Technical Writing and History of Science through courses in Humanities and Social Sciences.

In the second year (Semester - III), students have the freedom to choose their stream for masters program on the basis of their interest. Courses offered in the first two years would help them make an informed judgment to determine their real interest and aptitude for a given subject.

One of the important features that the CBS has adopted is semester-long projects called Lab projects and reading projects, which are given the same weightage as a regular course. By availing this, a student can work in an experimental lab or take up a theory project every semester. This is meant to help the student get trained in research methodology, which will form a good basis for

the 9th semester project work in the fifthyear. The subjects/courses are described further with their credit points. Few courses are common to different streams.

Program Outcomes

Integrated M.Sc. Zoology is 5-year, 10 semester course. The outcome goals can be realized by engaging with the diverse components integrated into the curriculum, as outlined below. Each of these components is meticulously crafted to yield particular outcomes sought upon the successful completion of the program.

PO-1	**Knowledge:** Provides deep understanding of all the theoretical as well as practical aspects in basic and applied areas of biological sciences especially animal sciences.
PO-2	**Critical Thinking and Reasoning:** Exhibit advanced critical thinking and reasoning skills, enabling them to critically evaluate and analyze complex biological fundamentals and experiments.
PO-3	**Problem Solving:** Applying the biological fundamentals and problem-solving skills to tackle intricate scientific and real-world issues.
PO-4	**Advanced Analytical and Computational Skills:** Proficient in employing advanced analytical techniques and computational tools to conduct in-depth biological problems and research.
PO-5	**Effective Communication:** Effectively communicate complex scientific concepts and research findings to both technical and non-technical audiences, using written reports, presentations, and teaching.
PO-6	**Social/Interdisciplinary Interaction:** Integrate biological concepts and methodologies into interdisciplinary contexts, collaborating effectively with professionals from various fields to address complex scientific and societal challenges.
PO-7	**Self-directed and Life-long Learning:** Recognize the importance of ongoing professional development and lifelong learning in the dynamic field of biological sciences and acquire knowledge and skills in different techniques related to animal sciences throughout their professional careers.
PO-8	**Effective Citizenship; Leadership and Innovation:** Capable to identify, formulate, investigate and analyze the scientific problems and innovatively to design and create products and solutions to real life problems.
PO-9	**Ethics:** Maintain the highest ethical standards in research and professional conduct within the field of animal sciences.
PO-10	**Further Education or Employment:** Pursue for Ph.D. program and get employment in academia, research institutions, industry, government, and other related sectors.
PO-11	**Global Perspective:** Recognize the global nature of scientific research in animal sciences and its impact, appreciating diverse cultural perspectives in scientific practices and considering international contexts in their work.

Program Specific Outcomes (PSOs)

Upon successful completion of the program students will be able to attain following outcomes-

PSO1	Comprehensive understanding of fundamentals, principles and practical aspects of biological sciences especially animal sciences
PSO2	Apply the knowledge of biology including animal sciences in interdisciplinary fields to address and solve societal issues.
PSO3	Apply the analytical instruments and computation programs ensuring precision, efficiency, and innovation in scientific research, industry, healthcare, environment and education.
PSO4	Proficiently convey and promote ideas in the field of biological sciences to disseminate knowledge and enhance the awareness about animal science research and concepts in the community.
PSO5	Qualify national and state-level examinations like GATE, NET, SLET, and SET can lead to career opportunities in academia, research, and related fields.

Integrated M.Sc. in Zoology

Specification of Course	Semester	No. of Courses	Credits
Core	I-IX	63	220
	➢ Theory	42	144
	➢ Practical	18	48
	➢ Project/Dissertation	03	28
Elective	X	04	20
Total		67	240
Additional Courses (Qualifying in nature, for Student admitted in CBS only)			
Additional Paper (EVS)	I	01	02
	II	01	02
Skill Enhancement /Value Added Courses	V	01	02
	VI	01	02
	VII	01	02
Skill Enhancement Course [only for Biology (Botany and Zoology) students]	VIII	01	02

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Course Structure for the Integrated M.Sc. Zoology Stream

Effective from Session 2024-25

(Abbreviation: B: Biology (Botany +Zoology), C: Chemistry, M: Mathematics, P: Physics, G: General, H: Humanities, BL: Biology Laboratory, CL: Chemistry Laboratory, PL: Physics Laboratory, GL: General Laboratory, ZE: Zoology Elective, Z: Zoology, ZL: Zoology Laboratory

- Minimum total credits for Integrated M.Sc. degree is 240.
- Semesters I to VIII will carry 25 credits each.
- Semesters IX and X will carry 20 credits each.

FIRST YEAR

Semester –I

Course Nature	Course Code	Course Title	Course Type (T/P)	Contact Hours /Week (Theory +Tutorials)	Credits	Marks		
						CIA	ESE	Total
Core	B101	Biology – I	T	[2 + 1]	3	60	40	100
Core	C101	Chemistry – I	T	[2 + 1]	3	60	40	100
Core	M101/MB101	Mathematics – I	T	[2 + 1]	3	60	40	100
Core	P101	Physics – I	T	[2 + 1]	3	60	40	100
Core	G101	Computer Basics	T	[2 + 1]	3	60	40	100
Core	H101	Communication Skills	T	[2]	2	60	40	100
Core	PL101	Physics Laboratory – I	P	[4]	2	60	40	100
Core	CL101	Chemistry Laboratory – I	P	[4]	2	60	40	100
Core	BL101	Biology Laboratory – I	P	[4]	2	60	40	100
Core	GL101	Computer Laboratory	P	[4]	2	60	40	100
		(25 of 240 credits)		**Total**	**25**			
Additional Paper	ES101	Environmental Studies	T	[2]	2	60	40	100

Semester- II

Course Nature	Course Code	Course Title	Course Type (T/P)	Contact Hours /Week (Theory +Tutorials)	Credits	Marks		
						CIA	ESE	Total
Core	B201	Biology – II	T	[2 + 1]	3	60	40	100
Core	C201	Chemistry – II	T	[2 + 1]	3	60	40	100
Core	M201/ MB201	Mathematics – II	T	[2 + 1]	3	60	40	100
Core	P201	Physics – II	T	[2 + 1]	3	60	40	100
Core	G201	Electronics and Instrumentation	T	[2 + 1]	3	60	40	100
Core	PL201	Physics Laboratory – II	P	[4]	2	60	40	100
Core	CL201	Chemistry Laboratory – II	P	[4]	2	60	40	100
Core	BL201	Biology Laboratory – II	P	[4]	2	60	40	100
Core	GL201	Electronics Laboratory	P	[4]	2	60	40	100
Core	H201	Communication Skills Lab	P	[4]	2	60	40	100
		(50 of 240 credits)		**Total**	**25**			
Additional Paper	ES201	Environmental Studies	T	[2]	2	60	40	100

SECOND YEAR

Semester- III

Course Nature	Course Code	Course Title	Course Type (T/P)	Contact Hours /Week (Theory +Tutorials)	Credits	Marks		
						CIA	ESE	Total
Core	CB301	Essential mathematics for Chemistry and Biology	T	[3 + 1]	4	60	40	100
Core	CB302	Biochemistry-I	T	[3 + 1]	4	60	40	100
Core	CB303	Organic Chemistry-I	T	[3 + 1]	4	60	40	100
Core	B301	Cell Biology – I	T	[3 + 1]	4	60	40	100
Core	H301	Creative Hindi	T	[2 + 0]	2	60	40	100
Core	H302 (IKS Course)	History and Philosophy of Science	T	[2 + 0]	2	60	40	100
Core	BL 301	Biology Laboratory	P	[6]	3	60	40	100
Core	GL301	Applied Electronics Laboratory	P	[4]	2	60	40	100
		(75 of 240 credits)		**Total**	**25**			

***H302 is Indian Knowledge System Course (IKS)**

Semester- IV

Course Nature	Course Code	Course Title	Course Type(T/P)	Contact Hours /Week (Theory +Tutorials)	Credits	Marks		
						CIA	ESE	Total
Core	PCB401	Physical and Chemical Kinetics	T	[3 + 1]	4	60	40	100
Core	CB401	Introductory Spectroscopy (UV-vis, fluorescence, IR, Raman, NMR)	T	[3 + 1]	4	60	40	100
Core	B 401	Cell Biology – II	T	[2 + 1]	3	60	40	100
Core	B 402	Biochemistry – II	T	[2 + 1]	3	60	40	100
Core	G401	Statistical Techniques and Applications	T	[3 + 1]	4	60	40	100
Core	BL 401	Biology Laboratory	P	[6]	3	60	40	100
Core	GL 401	Computational Laboratory and Numerical Methods	P	[4]	2	60	40	100
Core	H401	Communication Skills Lab	P	[4]	2	60	40	100
		(100 of 240 credits)		**Total**	**25**			

THIRD YEAR

Semester- V

Course Nature	Course Code	Course Title	Course Type (T/P)	Contact Hours /Week (Theory +Tutorials)	Credits	Marks		
						CIA	ESE	Total
Core	CB501	Analytical Chemistry	T	[3 + 1]	4	60	40	100
Core	B501	Genetics	T	[3 + 1]	4	60	40	100
Core	B502	Molecular Biology	T	[3 + 2]	5	60	40	100
Core	Z501	Biosystematics and diversity of Invertebrates	T	[3 + 2]	5	60	40	100
Core	H501	Scientific Writing in Hindi	T	[2]	2	60	40	100
Core	ZL-501	Zoology Laboratory		[10]	5	60	40	100
		(125 of 240 credits)		**Total**	**25**			
Skill Enhancement/Value Added Course								
	SEL501	English Language for Competence Skills	P	[4]	2	60	40	100

Semester- VI

Course Nature	Course Code	Course Title	Course Type (T/P)	Contact Hours /Week (Theory +Tutorials)	Credits	Marks		
						CIA	ESE	Total
Core	CB601	Biophysical Chemistry	T	[3 + 1]	4	60	40	100
Core	Z601	Structure and Function of Invertebrates	T	[2 + 1]	3	60	40	100
Core	Z602	Vertebrates	T	[2 + 1]	4	60	40	100
Core	Z603	Animal Physiology	T	[2 + 1]	4	60	40	100
Core	Z-604	Biology of Parasitism	T	[3 + 1]	3	60	40	100
Core	H601	Ethics in Science and IPR	T	[2 + 0]	2	60	40	100
Core	H602	Scientific Writing in English	T	[2]	2	60	40	100
Core	ZL-601	Zoology Laboratory	P	[6]	3	60	40	100
		(150 of 240 credits)		**Total**	**25**			
Skill Enhancement/Value Added Course								
	SEL-601	Pratiyogi Parikshao ke liye Hindi Bhasha	P	[4]	2	60	40	100

FOURTH YEAR

Semester- VII

Course Nature	Course Code	Course Title	Course Type (T/P)	Contact Hours /Week (Theory +Tutorials)	Credits	Marks		
						CIA	ESE	Total
Core	B-701	Evolutionary Biology	T	[3 + 1]	4	60	40	100
Core	B-702	Immunology	T	[3 + 1]	4	60	40	100
Core	Z-701	Developmental Biology of Animals	T	[3 + 1]	4	60	40	100
Core	B- 703	Imaging Technology in Biological Research	T	[3 + 1]	4	60	40	100
Core	ZPGD 701	Zoology PG Dissertation/Project	P	[8]	4	60	40	100
Core	ZL 701	Advanced Zoology Laboratory-I	P	[10]	5	60	40	100
		(175 of 240 credits)		Total	25			
Skill Enhancement/Value Added Course								
	SEL-701	Linux Operating System	P	[4]	2	60	40	100

Semester- VIII

Course Nature	Course Code	Course Title	Course Type (T/P)	Contact Hours /Week (Theory +Tutorials)	Credits	Marks		
						CIA	ESE	Total
Core	B-801	Virology	T	[3 + 1]	4	60	40	100
Core	B-802	Biotechnology – I	T	[3 + 1]	4	60	40	100
Core	B 803	Bioinformatics	T	[3 + 1]	4	60	40	100
Core	B 804	Biotechnology – II	T	[3 + 1]	4	60	40	100
Core	ZL 801	Advanced Zoology Laboratory-II	P	[10]	5	60	40	100
Core	ZPGD801	Zoology PG Dissertation / Project	P	[8]	4	60	40	100
		(200 of 240 credits)		Total	25			
Skill Enhancement/Value Added Course								
	SEBL-801	Statistical Tools in Biological Research	P	[4]	2	60	40	100

FIFTH YEAR

Semester- IX

Course Nature	Course Code	Course Title	Course Type (T/P)	Contact Hours /Week (Theory +Tutorials)	Credits	Marks		
						CIA	ESE	Total
Core	ZPGD901	Zoology PG Dissertation/ Project	P	-	20	-	400	400
		(220 of 240 Credits)		Total				

Semester- X*

Course Nature	Course Code	Course Title	Course Type (T/P)	Contact Hours /Week (Theory +Tutorials)	Credits	Marks		
						CIA	ESE	Total
Elective	BE-1001	Proteomics and Genomics	T	[4 + 1]	5	60	40	100
Elective	BE 1002	Nanobiotechnology	T	[4 + 1]	5	60	40	100
Elective	ZE1001	Animal Behaviour and Population Ecology	T	[4 + 1]	5	60	40	100
Elective	ZE1002	Neurobiology	T	[4 + 1]	5	60	40	100
Elective	ZE1003	Animal tissue culture	T	[4 + 1]	5	60	40	100
Elective	ZE1004	Applied Zoology	T	[4 + 1]	5	60	40	100
Elective	ZE1005	Endocrinology	T	[4 + 1]	5	60	40	100
Elective	BE1003	Earth science and energy & environmental sciences	T	[4 + 1]	5	60	40	100
		(240 of 240 credits)		Total	20			

***Four Subjects will be offered according to the availability of instructors and minimum number of interested students taking a course.**

Skill Enhancement/ Value Added Courses:
(Offered to the students of CBS)

The candidates who have joined the 5-Year Integrated M.Sc. Program in Center for Basic Sciences shall undergo Skill Enhancement Course /Value Added Course (only qualifying in nature).

Semester	Course Code	Course Title	Course (T/P)	Hrs/ Week	Credits	Marks		
						CIA	ESE	Total
V	SEL501	English Language for Competence Skills	P	4	2	60	40	100
VI	SEL601	Pratiyogi Parikshao ke liye Hindi Bhasha	P	4	2	60	40	100
VII	SEL701	Linux Operating System	P	4	2	60	40	100
VIII	SEBL801 [Only for Biology (Botanyand Zoology)]	Statistical Tools in BiologicalResearch	P	4	2	60	40	100

Indian Knowledge System Course:
(Offered to the students of CBS)

The candidates who have joined the 5-Year Integrated M.Sc. Program in Center for Basic Sciences shall undergo Indian Knowledge System course which is a core course.

Semester	Course Code	Course Title	Course Type (T/P)	Hrs/ Week	Credits	Marks		
						CIA	ESE	Total
III	H302	History and Philosophy ofScience	T	[2 + 0]	2	60	40	100

Programme Articulation Matrix

Following matrix depicts the correlation between all the courses of the programme andProgramme Outcomes

Course Code	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
B-101	√	√	√	×	√	√	√	√	×	√	√	√	√	√	√	√
C-101	√	√	√	×	√	√	√	√	×	√	√	√	√	√	√	√
MB-101	√	√	√	√	√	√	√	√	×	√	√	√	√	√	√	√
P101	√	√	√	√	√	√	√	√	×	√	√	√	√	√	√	√
G101	√	√	√	√	√	√	√	√	×	√	√	√	√	√	√	√
H101	√	√	×	×	√	√	√	√	×	√	√	√	√	√	√	√
ES101	√	√	√	×	√	√	√	√	×	√	√	√	√	√	√	√
BL101	√	√	√	×	√	√	√	√	×	√	√	√	√	√	√	√
PL101	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
CL101	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
GL101	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
B201	√	√	√	×	√	√	√	√	×	√	√	√	√	√	√	√
C-201	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
MB201	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
P201	√	√	√	√	√	√	√	×	√	√	√	√	√	√	√	√
G201	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
H201	√	√	√	×	√	√	√	√	×	√	√	√	√	√	√	√
ES201	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
BL201	√	√	√	×	√	√	√	√	×	√	√	√	√	√	√	√
PL201	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
CL201	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
GL201	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
CB301	√	√	√	×	√	√	√	√	×	√	√	√	√	√	√	√
CB302	√	√	√	×	√	√	√	√	×	√	√	√	√	√	√	√
CB303	√	√	√	√	√	√	√	×	√	√	√	√	√	√	√	√
B301	√	√	√	×	√	√	√	√	×	√	√	√	√	√	√	√
H301	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
H302	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
BL301	√	√	√	×	√	√	√	√	×	√	√	√	√	√	√	√
GL301	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
PCB401	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
CB401	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
B401	√	√	√	×	√	√	√	√	×	√	√	√	√	√	√	√
B402	√	√	√	×	√	√	√	√	×	√	√	√	√	√	√	√
G401	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
BL401	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
GL401	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
H401	√	√	×	×	√	√	√	√	√	√	√	√	√	√	√	√
CB501	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
B501	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
B502	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

Z501	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
H501	√	√	×	×	√	√	√	√	√	√	√	√	√	√	√	√	√
ZL501	√	√	√	×	√	√	√	√	√	√	√	√	√	√	√	√	√
CB601	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Z-601	√	√	√	×	√	√	√	√	√	√	√	√	√	√	√	√	√
Z-602	√	√	√	×	√	√	√	√	√	√	√	√	√	√	√	√	√
Z-603	√	√	√	×	√	√	√	√	√	√	√	√	√	√	√	√	√
Z-604	√	√	√	×	√	√	√	√	√	√	√	√	√	√	√	√	√
H601	√	√	√	×	√	√	√	√	√	√	√	√	√	√	√	√	√
H602	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
ZL601	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
B 701	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
B702	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Z701	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
B703	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
ZL701	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
ZPGD701	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
B801	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
B802	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
B803	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
B804	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Z L801	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
ZPGD801	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
ZPGD901	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
BE1001	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
BE1002	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
ZE1001	√	√	√	×	√	√	√	√	√	√	√	√	√	√	√	√	√
ZE1002	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
ZE1003	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
ZE1004	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
ZE1005	√	√	√	×	√	√	√	√	√	√	√	√	√	√	√	√	√
BE1003	√	√	√	×	√	√	√	√	√	√	√	√	√	√	√	√	√
	73	73	69	50	73	73	73	73	54	73	73	73	73	73	73	73	
SEL501	×	×	×	×	√	√	√	√	√	√	√	√	√	√		√	√
SEL601	×	×	×	×	√	√	√	√	√	√	√	√	√	√		√	√
SEL701	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√
SEBL801	√	√	√	×	√	√	√	√	√	√	√	√	√	√		√	√

Semester-wise Syllabus

Integrated M.Sc. Semester – I

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	1	I
Course Code	Course Title		Course Type
B-101	BIOLOGY -I		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
3	2	1	0
Maximum Marks	CIA		ESE
100	60		40

Learning Objective (LO):

The aim of this paper is to provide students with a comprehensive understanding of basic biology, the evolution of life, taxonomy and classification, cell biology, cellular systems, and tissue systems. It enables the students to identify living organisms and ecosystems characteristics and basic needs. It explains the processes of growth and development in individuals and populations.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	With this introductory paper students will be able to comprehend general biological processes which are essential for students of all the streams Physics, Chemistry or mathematics.	U
2.	Theories of origin of life, evolution and process of development on earth.	U
3.	Identification of the levels of biological organization.	E
4.	Cellular mechanism which will further improve the understanding of processes of living beings.	U
5.	Physiology of different organ systems of the human body.	U

CL: Cognitive Levels (R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	1	-	-	2	2	2	-	3	3	3	2	2	2	3
CO2	3	2	1	-	-	2	2	2	-	3	3	3	2	2	2	3
CO3	3	3	3	2	2	3	3	3	-	3	3	3	3	3	3	3
CO4	3	3	3	2	2	3	3	3	-	3	3	3	3	3	3	3
CO5	3	3	2	2	1	1	2	1	-	3	3	2	1	3	3	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: B 101 Biology I (Introductory Biology-I)

Unit No.	Topics	No. of Lectures	CO No.
I	Life: History and origin of life, Concepts of biological evolution, Darwinism,Lamarckism, natural selection, speciation.	8	1
II	Classification of living things: Classification and domains of life, overview of taxonomy of plants, animals and microorganisms.	7	2
III	Cell Biology: Discovery of cell, cell theory, classification of cell types, Prokaryotes and Eukaryotes, cell wall, cell membrane, cytoplasm, structure and functions of cell organelles.	10	3

IV	Cell Division and System Development: cell cycle, mitosis, meiosis, and mechanism of development (stem cells), formation of tissues, cell-cell interactions, respiration.	10	4
V	Morphology and Anatomy of flowering plants, photosynthesis. Major Human Body Systems: Digestive, Circulatory, Lymphatic, Respiratory system.	10	5

BOOKS SUGGESTED:

S.No.	Author	Book
1	Neil A Campbell and JB Reece (2007)	Biology with Mastering Biology (8th Edition)
2	NA Campbell, JB Reece, MR Taylor and EJ Simon (2008)	Biology: Concepts & Connections with biology (6th Edition)
3	Charles Darwin (2008)	On the Origin of Species
4	B Alberts, D Bray, K Hopkin and AD Johnson (2009)	Essential Cell Biology
5	Rene Fester Kratz (2009)	Molecular and Cell Biology For Dummies
6	MJ Behe (2006)	Darwin's Black Box: The Biochemical Challenge to Evolution
7	SD Garber (2002)	Biology: A Self Teaching Guide, (2nd Edition)

Integrated M.Sc. Semester – I

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	1	I

Course Code	Course Title	Course Type
ES-101	**Environmental Studies**	**Additional**

Credit	Hours Per Week (L-T-P)		
	L	T	P
2	2	0	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):

The objective of this course is to aware students about the ecology and environment. An environmental study helps individuals to develop an understanding of living and physical environment and how to resolve challenging environmental issues affecting the nature.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Concepts of ecology and environment which are important for the student of any stream	U
2.	Basic concept of renewable and non-renewable energy resources	An
3.	Understanding of hierarchy of food on different ecosystem	E
4.	Types and characteristics of major ecosystems	An
5.	Environmental issues and measures to deal with them. Owns' role as a responsible citizen.	Ap

CL: Cognitive Levels (R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	Pos											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	2	1	-	1	3	3	1	3	3	3	2	3	3	3
CO2	3	3	2	1	-	1	3	3	1	3	3	3	2	3	3	3
CO3	3	3	2	-	1	2	3	3	-	3	3	3	1	2	3	3
CO4	3	3	2	-	1	2	3	3	-	3	3	3	1	2	3	3
CO5	3	3	3	1	2	2	3	3	-	3	3	3	1	2	3	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: ES 101 Environmental Studies

Unit No.	Topics	No. of Lectures	CO No.
I	THE MULTI DISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES Definition ,scope and importanceNeed for publish awareness.	3	1
II	Natural Resources Renewable and non-renewable resources:Natural resources and associated problems. a. Forest resources: use and over – exploitation, deforestation, case studies, timber extraction, Mining, dams and their effects on forests andtribal people. b. Water resources: use and over-utilization of surface and ground water, floods, drought, Conflicts over water, dams benefits and problems . c. Mineral resources: use and exploitation, environmental effects of extracting and using Mineral resources, case studies. d. Food resources: World food problems, changes caused by agriculture and overgrazing, Effects of modern agriculture, fertilizer –pesticide problems , water logging , salinity Case studies. e. Energy resources: Growing energy needs, renewable and non-renewable energy sources Use of alternate energy sources, case studies. f. Land resources: land as a resources, land degradation, man induced	8	2
	landslides, soil erosion& desertification. g. Role of an individual in conservation of natural resources. h. Equitable use of resources for sustainable life –styles.		
III	Concept of an ecosystems. Structure and function of an ecosystem. • Producers, consumers and decomposers. • Energy flow in the ecosystem. • Ecological succession. • Food chains, food webs and ecological pyramids	6	3
IV	Introduction , types ,characteristic features , structure and function of theFollowing Ecosystem: • Forest ecosystem • Grassland ecosystem • Desert ecosystem • Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)	5	4

V	SOCIAL ISSUES AND THE ENVIRONMENT Environment Protection Act. • Air (prevention and control of pollution) Act. • Wildlife protection Act. • Forest conservation Act. • Issues involved in enforcement of environmental legislation. • Public awareness. • Value Education • HIV/ADIS • Women and child welfare. • Role of information technology in Environment and Human Health. • Case studies.	8	5

BOOKS SUGGESTED:

S. No.	Author	Title
1.	Agarwal K.C.	Environmental Biology 2001
2.	Bharucha Erach	The Biodiversity of India
3.	Bruinner R.C.	Hazardous Waste Incineration, 1989
4.	Bharucha E.	Textbook for Environmental Studies for undergraduate Courses
5.	Begon M., Town send C.R., Harper J.L.	Ecology From Individuals to Ecosystems

Integrated M.Sc. Semester – I

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	1	I

Course Code	Course Title	Course Type
BL-101	**Biology Laboratory – I**	**Core**

Credit	Hours Per Week (L-T-P)		
	L	T	P
2	-	-	4

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):
Lab practical are highly visual, and may involve things like identifying a structure through a microscope, preparation of slides. Biological Science practicals will develop thinking and reasoning skills. It will gratify intellectual instincts and will make students aware of our surroundings and ourselves.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Develop the ability to identify the unique characters of organisms, classify them, and understand the concept of evolution and phylogenetic tree	U
2.	Expertise in Microscopy and Micrometry	An
3.	Learn to prepare slide, staining of specimen and study of morphological characteristics. Differentiating dead v/s live cells using differential staining	E
4.	Acquire skills of section cutting stem, root, leaf and flower. Develop understanding of types, shapes and arrangements of leaves.	An
5.	Develop a deeper understanding of types of human blood cell by differential staining, and count the number of cells using Haemocytometer.	Ap

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	2	2	1	3	3	3	3	3	3	2	3	3	3
CO2	3	3	3	2	2	1	3	3	3	3	3	3	2	3	3	3
CO3	3	3	3	2	2	1	3	3	3	3	3	3	2	3	3	3
CO4	3	3	2	1	1	2	3	3	1	3	3	3	1	2	3	3
CO5	3	3	2	1	1	2	3	3	1	3	3	3	1	2	3	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: BL101 Biology Laboratory – I

S. No.	Experiment	No. of Lab	CO No.
I	**Introduction to Biology laboratory:** Taxonomy, Methods of Classification, Dichotomous key, Hierarchical Classification, Phylogenetic Classification	10	1
II	**Introduction to Light Microscopy** Micrometry: Measuring size of a microscopic specimen.	10	2
III	**Staining and Observing**: human cheek cells plant cells. Study morphological characteristics of *S. cerevesiae*, differentiating dead v/s live cells	12	3
IV	**Plant anatomy** Relationship between plant anatomy and habitat. Transverse section of dicot & monocot stem, root, leaf and flower. Observing and understanding types shapes and patterns of leaves.	16	4
V	**Staining human blood cells**: To observe human blood cell types by	12	5

	differential staining, Haemocytometer.		

Integrated M.Sc. Semester – II

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	1	II

Course Code	Course Title	Course Type
B-201	**Biology –II [Introductory Biology-II]**	**Core**

Credit	Hours Per Week(L-T-P)		
	L	T	P
3	2	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):
It will provide insight of cell structure, functioning and metabolism. Progress in medicine, agriculture, biotechnology, and various other biological domains has led to enhancements in the quality of life.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Students will be able to have a base knowledge about cell structure, function and role of biological molecules in regulating the basic mechanism of a cell.	U
2.	Understanding the concept of genetic material and gene regulation	U
3.	Students have the knowledge about structure and function of essential and non-essential proteins	E
4.	Know the process of Cell Signalling.	An
5.	Fundamentals of biotechnology and recombinant DNA technology.	C

CL: Cognitive Levels (R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	2	2	3	3	2	-	3	3	3	3	2	2	3
CO2	3	3	3	2	2	3	3	2	-	3	3	3	3	2	2	3
CO3	3	3	3	2	2	3	3	2	-	3	3	3	3	2	2	3
CO4	3	3	3	1	1	3	2	3	-	3	3	3	3	2	3	3
CO5	3	3	3	3	2	3	3	2	3	3	3	3	3	2	3	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: B 201 Biology II (Introductory Biology-II)

Unit No.	Topics	No. of Lectures	CO No.
I	Nucleic acids: DNA as the carrier of genetic information, Building blocks- nucleosides, nucleotides, DNA and RNA structure, types and function, chromatin structure, genes, repetitive DNA sequences.	8	1
II	Gene expression: Overview, genes regulatory elements, transcription mechanism in prokaryotes and eukaryotes (a comparison), Reverse transcription, genetic code.	7	2
III	Protein Structure and Function: Building blocks amino acids, peptides, secondary structure, three dimensional structure, membrane proteins, miscellaneous proteins, enzymes.	10	3
IV	Cell Signaling: Overview, signaling via hydrophobic molecules, signaling via ion channels, Signaling via G protein coupled receptors, signaling via cell surface enzymes, intracellular signalling.	10	4
V	Biotechnology:DNA cloning, Uses of recombinant DNA technology, Polymerase chain reaction (PCR), Production of recombinant proteins and SDS PAGE. Classification of living things: Classification and domains of life, overview of taxonomy of plants, animals and microorganisms.	10	5

BOOKS SUGGESTED:

r.no	Author	Book
1.	B Alberts, A Johnson, J Lewis, and M Raff	Molecular Biology of the Cell
2.	J D. Watson, T A.Baker, S P. Bell, & A Gann	Molecular Biology of the Gene (6th Edition)
3.	John Wilson and Tim Hunt (2007)	Molecular Biology of the Cell:The Problems
4.	Benjamin Lewin (2007)	Genes IX (Lewin, Genes XI)

Integrated M.Sc. Semester – II

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	I	II

Course Code	Course Title	Course Type
ES-201	**Environmental Studies-II**	**Additional**

Credit	Hours Per Week (L-T-P)		
	L	T	P
2	2	0	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):

Environmental studies foster awareness about biodiversity and both renewable and nonrenewable resources in a particular region. This involves assessing the available resources, their utilization patterns and the need to maintaina balance for future generations.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Students will realize that people are dependent on intact habitats that sustain the various organisms we need to produce food, medicines, clothing, and other materials. Students will learn about certain species roles in an ecosystem.	E
2.	To describe the main pollutants and their effects on human health. To develop an activity where the student puts into practice the knowledge acquired.	An
3.	Understand waste management vs. waste reduction. Define the concept of integrated waste management.	C
4.	Define 'population growth' list causes and issues related to population growth. Analyze population changes in specific countries.	Ap
5.	Evaluate all the environmental factors considering with at all points such as technical, social, legal and economical aspect.	E

CL: Cognitive Levels (R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	3	3	2	3	2	3	3	3	3	2	2	3
CO2	3	3	3	3	3	3	2	3	2	3	3	3	3	2	2	3
CO3	3	3	3	3	3	3	2	3	2	3	3	3	3	2	2	3
CO4	3	3	3	2	2	3	2	3	2	3	3	3	-	1	1	3
CO5	3	3	3	1	2	3	2	1	2	3	3	3	1	1	3	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"NoCorrelation

Detailed Syllabus: ES 201 Environmental Studies-II

Unit No.	Topics	No. of Lectures	CO No.
I	Biodiversity and its Conservation: Introduction- Definition: genetics, species and ecosystem diversity. Bio geographical classification of India. Value of biodiversity: consumptive use productive use, social, ethical, aesthetical and option value. Biodiversity at global, National and local levels. India as mega- diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in situ and ex-situ conservation of biodiversity.	6	1
II	Environmental pollution. Definition Causes, effects and control measures of- a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Nuclear hazards.	6	2
III	Solid waste management: Causes, effects and control measures of urban andindustrial wastes. Role of an individual in prevention of pollution. Pollution case studies Disaster management: floods, earthquake, cyclone and landslides.	6	3
IV	Human population and the Environment: Population growth, variation among nation. Population explosion- Family welfare programme. Environment and human health. Human Rights.	6	4
V	Social Issues and the Environment: From unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water	6	5

	harvesting, watershed management. Resettlement and rehabilitation of people, its problems and concerns. Case studies. Environment ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products.		

BOOKS SUGGESTED:

S. N.	Author	Title
1.	Agarwal K.C.	Environmental Biology 2001
2.	Bharucha Erach	The Biodiversity of India
3.	Bruinner R.C.	Hazardous Waste Incineration, 1989
4.	Bharucha E.	Textbook for Environmental Studies for undergraduate courses
5.	Begon M., Town C.R., Harper J.L.	Ecology From Individuals to Ecosystems

Integrated M.Sc. Semester – II

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	1	II

Course Code	Course Title	Course Type
BL-201	**Biology Laboratory – II**	**Core**

Credit	Hours Per Week (L-T-P)		
	L	T	P
2	-	-	4

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):

Students will have the basic instrumentation used in biology laboratory. They will be able to Design and criticallyassess the scientific investigations. It will also demonstrate critical thinking skills.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Gain the proficiency in a wide range of experimental instruments and methods in biology including Micro-Pipettes, Tissue Homogenizer, Electrophoresis apparatus, Colorimeter & Ultraviolet And Visible (Uv-Vis) Absorption, Laminar air flow system, Centrifuges, Spectrophotometer, Sonicator, PCR and Real-time PCR, Gel Documentation system and various Incubators	An
2.	A demonstration of polymerase chain reaction on thermal cycler. A demonstration on SDS-PAGE technique and DNA gel electrophoresis.	AP
3.	Able to observe Microscopic cells and even measure their size and count the number. Observe the dividing cells and differentiate between the cells using various staining methods.	AP
4.	Microscopic observation and comparative study of various microbes, and theirprimary characterization.	AP
5.	Gain practical experience of estimation biomolecules like Carbohydrate, protein content. .	AP

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	2	2	3	1	3	3	3	3	3	3	3	3
CO2	3	3	3	2	2	1	2	1	3	3	3	3	3	3	3	3
CO3	3	3	3	2	2	1	3	1	3	3	3	3	3	2	-	3
CO4	3	3	3	-	2	1	3	1	3	3	3	3	3	3	3	3
CO5	3	3	3	-	2	1	3	1	3	3	3	3	3	3	3	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: BL201 Biology Laboratory – II

S. No.	Experiment	No. of Lab	CO No.
I	**Use and maintenance of Instruments:** Micro-Pipettes, Tissue Homogenizer, Electrophoresis apparatus, Colorimeter & Ultraviolet And Visible (Uv-Vis) Absorption, Laminar air flow system, Centrifuges, Spectrophotometer, Sonicator, PCR and Real-time PCR, Gel Documentation system and various Incubators	10	1
II	A demonstration of polymerase chain reaction on thermal cycler. A demonstration on SDS-PAGE technique and DNA gel electrophoresis.	8	2
III	**Microscopic observation** Bacterial cell counting using Neubauer chamber, mitosis in onion root tips, Gram Staining: To differentiate bacteria cells by Gram staining.	16	3
IV	Microscopic observation and comparative study of various microbes, and their primary characterization.	12	4
V	Qualitative estimation biomolecules like Carbohydrate, protein content, amino acid, DNA, RNA.	14	5

Integrated M.Sc. Semester – III

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	2	III

Course Code	Course Title	Course Type
CB-302	**Biochemistry-I**	**Core**

Credit	Hours Per Week (L-T-P)		
	L	T	P

4	3	1	0
Maximum Marks	CIA		ESE
100	60		40

Learning Objective (LO):
Biochemistry combines biology and chemistry to study living matter. It powers scientific and medical discovery in fields such as pharmaceuticals, forensics and nutrition. With biochemistry, students will study chemical reactionsat a molecular level to better understand the world and develop new ways to harness these.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	To define the pH scale as a measure of acidity of a solution. Tell the origin and the logic ofusing the pH scale	Ap
2.	Describe the different types of simple and complex carbohydrates. Describe the functions ofcarbohydrates in the body. Describe the body's carbohydrate needs and how personal choices can lead to health benefits or consequences.	Ap
3.	Recognize the different types of lipids. Distinguish saturated from unsaturated fatty acids.Recognize lipids as important constituents of membranes.	E
4.	To understand how enzymes function so that we can better understand the function of our cells and treat diseases.	An
5.	Be aware, on a basic level, of how the structure of a protein can influence its interaction withother biomolecules.	An

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/ CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	3	3	2	3	2	3	2	3	3	3	2	3
CO2	3	3	2	2	3	2	2	2	-	2	2	3	3	3	2	3
CO3	3	3	3	3	3	3	2	3	2	3	2	3	3	3	2	3
CO4	3	3	2	2	3	2	2	2	-	2	2	3	3	2	2	2
CO5	3	3	2	2	3	3	2	2	-	3	2	3	3	2	2	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: CB 302 Biochemistry-I

UnitNo.	Topics	No. of Lectures	CO No.
I	General biochemistry concepts: The concept of pH, dissociation and ionizationof acids and bases, pKa, buffers and buffering mechanism, Henderson Hasselbalch equation, dissociation of amino acids and determination of pKa.	10	1
II	Chemical structure of: carbohydrate, lipids, nucleic acids, proteins. Properties and classification of carbohydrates-monosaccharides, di-, oligo- and polysaccharides, cellulose, lignin, cell wall, Sugar derivatives, Glycosidic Bonds.	10	2
III	Enzymes: characteristics, nomenclature and classification. Mechanism of enzyme action, enzyme kinetics, enzyme inhibition and	10	3

	regulation.		
IV	Structure and Functions of Lipid: General properties; Classifications: fatty acid,	15	4
	fats, oils, waxes, cholesterol, phospholipids, glycolipid, glycocalyx, Vitamins, Hormones		
V	Protein structure and function: levels of structure of protein, Classification of proteins-globular and fibrous, Protein folding and modification, proteolysis, ubiquitin- proteasome.	15	5

BOOKS SUGGESTED:

S.No.	Author	Book
1	D. L. Nelson & M. M. Cox	Lehninger Principles of Biochemistry
2	Stryer L (1995)	Biochemistry, 4 th edition,
3	Starzak, Michael E.	Energy and Entropy equilibrium to stationary states
4	J. McMurry (1999)	Fundamentals of General Organic & Biological Chemistry

Integrated M.Sc. Semester – III

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	2	III

Course Code	Course Title	Course Type
B-301	**Cell Biology -I**	**Core**

Credit	Hours Per Week(L-T-P)		
	L	T	P
4	3	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):

Cell biology aims to understand the structure and physiological function of individual cells, how they interact withtheir environment, and how large numbers of cells coordinate with each other to form tissues and organisms.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Students will understand the structures and purposes of basic components of prokaryotic andeukaryotic cells, especially macromolecules, membranes, and organelles	U
2.	Describe how organisms use physical phenomena to actively transport nutrients. Define osmosis, diffusion and semi-permeable membranes and understand how organisms use them	C
3.	Identify organelles in a cell and their function. Students will understand how these cellularcomponents are used to generate and utilize energy in cell	E
4.	Describe the significance of different cytoskeletal components in homeostasis and disease as well as in different cell types.	Ap
5.	Genome maintenance activities including DNA repair, cell division cycle control, and checkpoint signaling pathways preserve genome integrity and prevent disease.	An

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	3	2	2	1	2	3	2	3	3	3	2	3
CO2	3	3	3	3	2	2	2	1	1	2	2	3	3	3	2	3
CO3	3	3	3	2	3	1	2	1	-	2	2	3	2	3	3	3
CO4	3	3	3	2	3	1	2	1	-	2	2	3	2	3	2	3
CO5	3	3	3	1	3	1	2	1	-	2	2	3	3	2	3	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: B 301 Cell Biology -I

Unit No.	Topics	No. of Lectures	CO No.
I	Visualization of cell- History of cellular imaging; principles and applications oflight microscopy, Different microscopic techniques for imaging cells-phasecontrast, confocal, SEM, TEM.	10	1
II	Membrane system: The cell membrane and its structure, Models of the biomembrane: Charles Overton's "Lipid Membrane", Lipid monolayer model of Irwing Langmuir, Lipid bilayer model by Gorter and Grendel, Protein containing lipid bilayer model of Daveson and Danielly, David Robertson's direct observation of the membrane, Fluid Mosaic model of Singer and Nicholson, Constituents and fluidity of plasma membrane, Transport acrossmembrane, Ion channels.	10	2
III	Cellular organelles and their functions: Mitochondria: Structure of mitochondria, Different enzymes and their location, Electron transport complexes, ATP synthase, Mitochondrial DNA, Structure of chloroplast, Protein complexes and photosynthetic electron transport chain, DNA of the chloroplast, Structure and functions of the ribosomes, Endoplasmic reticulum, Golgi body, Lysosomes and Nucleus.	15	3
IV	Cytoskeleton, cilia and flagella: Structure and functions of Microtubules, microfilaments, and Intermediate filaments. Structure and function of tubulin, actin Molecular motors-structure and mechanisms of kinesins and dyneins. Myosin motor protein. Cilia and flagella: structure and functions and mechanism of movement.	15	4
V	Replication and Maintenance of the genome: DNA replication, DNA damageand repair, DNA rearrangements.	10	5

BOOKS SUGGESTED:

S. No.	Author	Book
1	D. L. Nelson & M. M. Cox	Lehninger, Principles of Biochemistry
2	Stryer L (1995	Biochemistry,
3	Gerald Karp	Cell and Molecular Biology

Integrated M.Sc. Semester – III

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	2	III

Course Code	Course Title	Course Type
BL-301	Biology Laboratory	Core

Credit	Hours Per Week (L-T-P)		
	L	T	P
3	-	-	6

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):

Study of biological phenomena at cellular and molecular level will be studied to gain knowledge about the principles that govern complex biological systems. It provides the information on concept of biochemical calculation and understands the physiological and biochemical significance of enzymatic reactions. This course will also help the student to know the clinical aspects of various disorders due to deficiency of nutrients.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Deep knowledge of pH, pKa, Buffers, and buffering mechanisms	AP
2	Proficient in Extraction and estimation oftotal free amino acids by ninhydrin reagent, and Estimation of acid value, Iodine number, Saponification value, Peroxide value in unsaturated fats and oils	AP
3	Depth knowledge of the Carbohydrate extraction, estimation and identificationfrom various sources like fruit sample, potato starch, qualitative tests of carbohydrates, identification by anthrone method, thin layer chromatography	AP
4	Apply enzymatic reaction; know the effects of pH, temperature and inhibitors on enzyme kinetics. Develop expertise on enzyme catalyzed reaction	AP
5	Understanding the practical insights into the formation of capsule, cell wall, lipid granules, metachromatic granules, endospores, Cell motility, Subcellular fractionation, western blotting and meiosis.	AP

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/ CO	POs											PSO			
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4
CO1	3	3	3	2	2	3	3	3	2	3	2	3	2	3	2
CO2	3	3	3	2	2	2	2	3	2	2	2	3	3	2	2
CO3	3	3	3	2	2	2	2	2	2	2	2	3	2	2	2
CO4															

	3		3	3	2	2	3	3	3	2	3	2	3	3	3	2	3
CO5	3		3	3	2	2	2	2	2	2	2	2	3	2	2	2	2

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: BL301 Biology Laboratory

S. No.	Experiment	No. of Lab	CO No.
I	**Biochemical calculation**: Concept of pH & Buffers, Hydrogen ion concentration in solution, Inorganic ion concentration in solutions, Inorganic Buffers and Biological fluids, Henderson-Hesselbach equation, Strong acid strong base titration, weak acid strong base titration, Aminoacid titration, determine the pka value of the provided amino acid solutions using titration curve. Identify the amino acids using the reference table on the basis of pka values obtained	15	1
II	**Extraction and estimation of** total free amino acids by ninhydrin reagent **Estimation of** acid value, Iodine number, Saponification value, Peroxidevalue in unsaturated fats and oils	10	2
III	**Carbohydrate extraction, estimation and identification** Extraction of carbohydrates from various sources like fruit sample, potato starch, qualitative tests of carbohydrates, identification by anthrone method, thin layer chromatography	15	3
IV	**Enzyme kinetics** Enzymatic reaction, determination of Vmax and Km for individuals salivary amylase, effects of pH and temperature on enzyme kinetics, Effect of inhibitors on enzyme kinetics, study an enzyme catalyzed reaction using hydroquinone as a substrate and peroxidase extracted from cabbage.	10	4
V	**Cell staining** – capsule, cell wall, lipid granules, metachromatic granules, endospores, Cell motility, Subcellular fractionation of mouse liver tissue, page & western blotting Immunoflourescence of cytoskeleton & nuclear proteins.	10	5

Integrated M.Sc. Semester – IV

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	2	IV
Course Code	Course Title		Course Type
B-401	**Cell Biology -II**		**Core**
Credit	Hours Per Week(L-T-P)		
	L	T	P
4	3	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):
This course will help in broadening the knowledge of the biological functions of all living beings. It will providedeep knowledge signal transduction, cell division etc.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Students will able to describe cell junctions found in plant cells (plasmodesmata) and animalcells (tight junctions, desmosomes, gap junctions).	E
2.	Understand the basic principles of signal transduction mechanisms, in particular the conceptsof response specificity, signal amplitude and duration, signal integration and intracellular location.	U
3.	Explain how cell division functions in reproduction, growth, and repair.	E
4.	Introduce the basic concept of physiological cell death referred to as apoptosis	U
5.	Techniques are used to study the physiological properties of cells, their structure, the organelles they contain, interactions with their environment, their life cycle, division, death and cell function	C

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	1	3	1	2	1	-	2	2	3	3	3	2	3
CO2	3	3	3	3	2	2	2	2	-	3	2	3	3	3	3	3
CO3	3	3	3	2	3	2	2	2	-	3	2	3	2	3	3	3
CO4	3	3	3	2	3	1	2	1	-	2	2	3	2	3	2	3
CO5	3	3	3	3	3	1	2	1	2	2	2	3	3	2	3	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: B 401 Cell Biology -II

Unit No.	Topics	No. of Lectures	CO No.
I	Cell Junctions, Cell Adhesion, and the Extracellular Matrix: Introduction, Cell Junctions, Cell Cell Adhesion, The Extracellular Matrix of Animals, Extracellular Matrix Receptors on Animal Cells. Integrins, Selectins, and other proteins involved in intercellular contacts. The Plant Cell Wall	10	1
II	Cell signaling: 1. Introduction: Components involved in signaling, Types of signaling, Three Major Classes of Signaling Receptors: Ion Channel linked, G protein coupled receptors (GPRs), Enzyme Linked receptors: Tyrosine Kinase Receptors, other enzyme linked receptors, Second Messengers: cAMP, cGMP, IP3 and DAG, Ca+2, PIP3. Signaling Cascades.	15	2
III	Cell cycle and Cell division: Mechanisms and regulations of cell division,Cyclins and CDKs, Key events in G1 Phase, S-Phase, G2 Phase and Mitosis.	15	3

	Cell cycle checkpoints, Molecular mechanism of cytokinesis, uncontrolled cell division and cancer.		
IV	Types of cell death: Apoptosis-Molecular mechanisms of apoptosis; Keyproteins involved in apoptosis: Pro- and anti-apoptotic proteins. Necrosis,Anoikis, Oncosis, autophagy.	10	4
V	Techniques in Cell biology: Cell fractionation, DNA libraries, DNA transferinto eukaryotic cells and Mammalian embryos, Nucleic acid hybridization,Purification of nucleic acid, Isolation and fractionation of proteins.	10	5

BOOKS SUGGESTED:

S.No.	Author	Book
1	Alberts et al.	Molecular biology of the Cell
2	Alberts, Bray et al	Essential Cell Biology Garland, Publication New York 1997
3	James E. Darnell, Harvey F. Lodish, and David Baltimore	Molecular Cell Biology
4	Geoffrey M Cooper	The Cell, 2nd edition, A Molecular Approach
5	Gerald Karp	Cell and Molecular Biology

Integrated M.Sc. Semester – IV

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	2	IV

Course Code	Course Title	Course Type
B-402	**Biochemistry-II**	**Core**

Credit	Hours Per Week(L-T-P)		
	L	T	P
4	3	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):

To unravel the complex chemical reactions that occur in a wide variety of life forms which will provide the basis for practical advances in medicine, veterinary medicine, agriculture, and biotechnology. It underlies and includes such exciting new fields as molecular genetics and bioengineering.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Evaluate the role of conversion of energy for cellular activities in any biological system	E
2.	Describe the metabolism of carbohydrates, lipids, proteins and amino acids.	An
3.	Write chemical reactions for the individual steps in each pathway. Identification of the levelsof biological organization.	E
4.	To know the digestion and absorption of carbohydrates. It knows where the products from the carbohydrate metabolism intermediate products are used in the body.	Ap
5.	Write the chemical reactions involved in biochemical pathways that produce ATP, such as citric acid cycle and electron transport.	C

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	2	3	3	3	3	2	2	3	2	3	3	3	3	3
CO2	3	3	2	2	2	3	3	2	1	3	2	3	3	2	3	3
CO3	3	3	2	2	2	2	2	2	-	3	2	3	3	2	2	3
CO4	3	3	2	2	2	2	2	1	-	2	2	3	3	2	2	3
CO5	3	3	2	1	2	2	2	1	-	2	2	3	3	2	2	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: B 402 Biochemistry-II

Unit No.	Topics	No. of Lectures	CO No.
I	Bioenergetics, and Basic concepts of Metabolism: catabolism and anabolism. Carbohydrate metabolism: Glycolysis and regulation, Feeder pathways of glycolysis, cori cycle, oxygen debt, Pasteur effect, Fates of pyruvate, ATP, NADH	15	1
II	TCA cycle, regulation, Gluconeogenesis, Glycogenolysis, Pentose phosphatepathway, Glyoxalate cycle. ETC, inhibitors of ETC, Oxidative Phosphorylation, chemiosmotic theory	15	2
III	Lipid metabolism: B oxidation of unsaturated and saturated fatty acids, propionyl Co A metabolism, significance of ketone bodies, biosynthesis of palmitate, Absorption and transport of fats.	10	3
IV	Amino acid Metabolism: Transamination, Deamination, Fate of amino acid skeleton, urea cycle, precursors of compounds other than proteins.	10	4
V	Nucleotide Metabolism: Salvage and De novo pathways of purines and pyrimidines, formation of deoxyribonucleotides, origin of thymine	10	5

BOOKS SUGGESTED:

S.No.	Author	Book
1	D.L. Nelson, M.Cox	Lehninger Principles of Biochemistry
2	Stryer L	Biochemistry
3	Starzak Michael E.	Energy and Entropy equilibrium to stationary states
4	J McMurry	Fundamentals of General Organic and Biological Chemistry (StudyGuide)

Integrated M.Sc. Semester – IV

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	2	IV
Course Code	**Course Title**		**Course Type**
BL-401	**Biology Laboratory**		**Core**
Credit	**Hours Per Week (L-T-P)**		
	L	T	P
3	-	-	6
Maximum Marks	**CIA**		**ESE**
100	60		40

Learning Objective (LO):

Explain the role of compartmentalization and signalling in cellular biology; Interpret and explain key experiments of cell biology; Evaluate and apply knowledge of modern techniques in cellular biology. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Gain expertise in Isolation and Analysis of Biomolecules like carbohydrate, protein,RNA and DNA estimation	AP
2	Understand the mechanism of Nucleic acid extraction and their quantification. Having the practical knowledge about the ability of DNA to withstand pH and Temperature.	AP
3	Gain expertise on Chromatography (Paper chromatography, Thin layer chromatography, Ion-exchange chromatography, affinity chromatography etc.)	AP
4	Deep understanding of programmed Cell Death, DNA Laddering and Cell death assay	AP
5	Students will able to detect blood group and Rh factor in the blood sample.	AP

CL: Cognitive Levels (**R**-Remember;**U**-Understanding;**Ap**-Apply;**An**-Analyze;**E**-Evaluate;**C**-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	2	2	3	3	2	2	2	2	3	3	2	2	2
CO2	3	3	3	2	2	2	3	2	2	2	2	3	3	2	2	2
CO3	3	3	3	3	3	2	3	2	2	2	2	3	3	2	2	2
CO4	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

SN	Detailed Syllabus: BL401 Biology Laboratory Experiment	No. of Lab	CO No.
I	**Isolation and Analysis of Biomolecules** (i) Carbohydrate estimation by DNSA (ii) protein estimation by Peterson method (iii) RNA estimation by Orcinol method (iv) DNA estimation by DPA method	20	1
II	**Nucleic acid extraction** - from plant & animal tissue using ethanol precipitation Estimation using Agarose gel electrophoresis Analysis of DNA under various conditions – pH and Temperature	20	2
III	**Chromatography** (a) Paper chromatography-chromatography of amixture of amino acids (b) TLC, Gel filtration (c) Ion-exchange chromatography, affinity chromatography	20	3
IV	**Study** Programmed Cell Death DNA Laddering and Cell death assay (quantification by Evans Blue), Barr bodies and Meiosis using lily anthers	10	4
V	**To detect** blood group and Rh factor in the blood sample, .Introducing undergraduate students to real-time PCR, Isolation of organelles: mitochondria, chloroplast, nucleus, lysosome and their assay by succinate dehydrogenase activity (mitochondria), acid phosphatase activity (lysosome), acetocarmine staining (nucleus) and microscopic observation (chloroplast).	20	5

Integrated M.Sc. Semester – V

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	3	V

Course Code	Course Title	Course Type
B-501	**Genetics**	**Core**

Credit	Hours Per Week (L-T-P)		
	L	T	P
4	3	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):
To develop deep understanding of genes and heredity of how certain qualities or traits are passed from parents to offspring as a result of changes in DNA sequence. The causes of important human diseases are being discovered, and therapies developed, based on fundamental genetic investigations.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Compare and explain the inheritance of germline and somatic mutations. Describe the sequence of events involving DNA in meiosis from chromosome duplication through chromosome segregation.	U
2.	The transmission to the future generation of various traits that are because of alleles at gene loci on a sex chromosome is known as sex-linked inheritance.	An
3.	Understanding of bacterial genetics that allowed researchers to implant foreign DNA in their genome and produce proteins that have benefited humans	C

4.	Understand the link between environment and evolution. Be familiar with the different agents of evolution	Ap
5.	Calculate the measures of the centre of data: mean, median, and mode. Recognize and calculate the measures of the spread of data: variance, standard deviation, and range.	An

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
CO2	3	3	3	2	3	2	3	2	1	3	2	3	3	2	2	2
CO3	3	3	3	2	3	2	3	2	1	3	2	3	3	2	2	3
CO4	3	3	3	2	3	3	3	3	1	3	2	3	3	3	2	3
CO5	3	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: B501 Genetics

Unit No.	Topics	No. of Lectures	CO No.
I	Overview and Introduction of Genetics: Central Dogma, Genotype and Phenotype, Eukaryotic and Prokaryotic Genes, Forward and Reverse Genetics, Mendelian Inheritance: Law of Dominance, Law of Segregation, Law of Independent Assortment, Deviation from Mendelism: Incomplete dominance, Co-dominance.	10	1
II	Epistasis, Polygeneic Inheritance, Cytoplasmic Inheritance, Linkage and Recombination, Sex Linkage and Sex-Linked Inheritance, Pedigree Analysis	10	2
III	Bacterial Genetics: Transformation, Conjugation, Transduction (Lambda Phage), Human genome and genetics: Elements of human genetics & genetic disorders, Examples from *Drosophila*, yeast, maize and mouse, Immunogenetics.	15	3
IV	Genes and Evolution: The law of DNA constancy and C value paradox: Numerical and structural changes in chromosomes; Molecular basis of spontaneous and induced mutations and their role in evolution; Environmental mutagenesis and toxicity testing; Population genetics	10	4
V	Biostatistics: Principles and practice of statistical methods in biological research; samples and populations; Basic statistics – average, statistics of dispersion, coefficient of variation; Standard error; Confidence limits; Probability distributions binomial, Poisson and normal; Tests of statistical significance; Simple correlation of regression; Analysis of variance.	15	5

BOOKS SUGGESTED:

S. No.	Author	Book
1	E. J. Gardner, D.P Snustad and M. J Simmons	Principles of Genetics
2	Leland Hartwell, Leroy Hood, Michael Goldberg, Ann Reynolds, Lee Silver, Ruth	Genetics: From genes to genomes
3	Anthony J. F. Griffiths. 2010	Introduction to genetic analysis
4	Harvey Motulsky, 2010	Intuitive Biostatistics: A Nonmathematical Guide to Statistical Thinking

5	Marcello Pagano, 2000	Principles of Biostatistics
6	Peter J. Russell	Genetics:A Molecular Approach

Integrated M.Sc. Semester – V

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	3	V

Course Code	Course Title	Course Type
B-502	**Molecular Biology**	**Core**

Credit	Hours Per Week (L-T-P)		
	L	T	P
5	3	2	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):

It will provide understanding of how molecules interact with one another in living organisms to perform the functions of life. Give knowledge of Major application of molecular biology are genetic analysis and gene cloning,DNA fingerprinting and forensics, genomics and computational approaches to genetics.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Construct a model of the structure of the DNA molecule. Define key terms associated with the structure of DNA. Identify the four nitrogen bases that compose DNA. Summarize the history of human knowledge about DNA.	U
2.	Outline the basic steps involved in DNA replication, including major differences betweeneukaryotes and bacteria. Explain how eukaryotes overcome the difficulty of replicating the ends of linear chromosomes.	U
3.	Understand the purpose of the cell's performing transcription and translation. Predict RNAand protein sequences from a given gene. Analyze the effects of a DNA mutation on the RNA and protein produced from that DNA.	An
4.	Gene regulation is necessary for making or synthesizing correct proteins where they arerequired. So it maintains the stability of the body. Hence, homeostasis is an outcome of gene regulation.	An
5.	State the potential effects of mutations on proteins produced as being beneficial, neutral, or harmful, the outcome of recombination is to ensure that each gamete includes both maternallyand paternally derived genetic information	An

CL: Cognitive Levels (**R**-Remember;**U**-Understanding;**Ap**-Apply;**An**-Analyze;**E**-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	3	3	3	2	2	3	2	3	3	2	3	3
CO2	3	3	3	2	3	2	3	2	-	3	2	3	3	2	2	3
CO3	3	3	3	2	3	2	3	2	-	3	2	3	3	2	2	3
CO4	3	3	3	2	3	2	3	2	-	3	2	3	3	2	3	3
CO5	3	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: B 502 Molecular Biology

Unit No.	Topics	No. of Lectures	CO No.
I	Molecular biology an overview: Concept and definition of the gene, complexityof the eukaryotic gene. Structural organization of the DNA in the nuclear material General properties of histones, nucleosomes and solenoid structure, RNAs and their structure & function.	15	1
II	DNA synthesis: The enzymes of DNA replication in prokaryotes andeukaryotes, mechanism of replication in bacteria and viruses, reverse transcriptase, salient features of eukaryotic nuclear and mitochondrial DNA replication.RNA synthesis: The enzymes of transcription in prokaryotes and eukaryotes, mechanism of transcription in bacteria, heteronuclear RNA, post transcriptional processing of RNA, role of ribozymes.	15	2
III	Protein synthesis: Concept of the genetic code, structure of t RNA and r RNA, enzymes of translation in prokaryotes and eukaryotes, mechanism of protein synthesis, post translational processing of proteins, translational inhibitors. Protein sorting, Vesicular traffic inside the cells, targeting & degradation	15	3
IV	Gene expression and its characterization: Regulation of gene expression inprokaryotes, eukaryotes, λ phage, structure and mechanism of different operons, Gene regulation during development, Gene function and phenotype loss of function & gain of function, Gene interaction, suppressors & enhancers.	15	4
V	Mutations and their consequences: Definition of mutation, mutagenesis & mutant selection, Alleles, Complementation, Recombination, recombination mapping and mechanism of recombination, Repair of DNA, Transposons & retroposons.	15	5

BOOKS SUGGESTED:

S. No.	Author	Book
1	Stryer L	Biochemistry, 4 th edition,
2	Watson J. D., Hopkins, N. H., Roberts, J. W., Steitz, J. A. and Weiner, A. M.	Molecular biology of the gene, 4th edition, The Benjamin/Cummings publishing companies
3	Benjamin Lewin	Genes VII, oxford University Press, Oxford
4	Weaver R. F.	Molecular biology
5	Brown T A	Essential molecular biology, vol. I, A practical approach, IRL press, Oxford.
6	Cox Lynne S	Molecular Themes in DNA Replication
7	Gerald Karp	Cell and Molecular Biology

Integrated M.Sc. Semester – V

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	3	V
Course Code	**Course Title**		**Course Type**
Z-501	**Biosystematics and diversity of Invertebrates**		**Core**
Credit	**Hours Per Week(L-T-P)**		
	L	**T**	**P**
5	3	2	0
Maximum Marks	**CIA**		**ESE**
100	60		40

Learning Objective (LO):

The aim is to equip students with a comprehensive understanding of the classification, evolutionary relationships, and ecological significance of invertebrate organisms. Students will explore the principles and methodologies of biosystematics, including taxonomic classification, phylogenetic analysis, and nomenclature systems. They will analyze the diversity of invertebrate phyla, emphasizing morphological, physiological, and behavioral adaptations to various environments.

Course Outcomes (CO)

`CO No.	At the end of the course, the students will be able to:	CL
1.	Students will grasp foundational concepts in biosystematics and taxonomy, including nomenclature and classification theories. They'll learn taxonomic procedures, specimen collection, preservation, and identification techniques, as well as numerical and molecular taxonomy.	U
2.	Learners will understand key procedures in taxonomy, typification processes, and classification purposes. They'll differentiate between biological, artificial, and natural classifications, evaluating merits and demerits of taxonomic keys.	U
3.	Students will classify and comprehend the locomotion, nutrition, and reproduction of Protozoa, Porifera, Coelenterata, focusing on morphological and physiological characteristics.	Ap
4.	Learners will analyze the general organization and life cycles of Trematoda, Nematoda, including specific examples like Polychaeta. They'll explore respiratory mechanisms and larval forms in Arthropoda.	U
5.	Students will classify Platyhelminthes, and Nemathehelminthes with the example of Liver fluke and Schistosoma. Life cycle and larval form of parasitic helminthes.	E

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	Pos											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	1	1	2	2	2	3	3	3	3	2	2	2	3
CO2	3	3	3	1	1	2	2	2	3	3	3	3	2	2	2	3
CO3	3	3	3	1	1	2	2	2	3	3	3	3	2	2	2	3
CO4	3	3	3	1	1	2	2	2	3	3	3	3	2	2	2	3
CO5	3	3	3	1	1	2	2	2	3	3	3	3	2	2	2	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"NoCorrelation

Detailed Syllabus: Z 501 Biosystematics and diversity of Invertebrates

Unit No.	Topics	No. of Lectures	CONo.
I	Definition & basic concepts of Biosystematics, Biological classification, Taxonomy, Different types of taxonomic characters, Hierarchy, Taxonomic procedure, Keys in taxonomy, Zoological types, Zoological nomenclature-ICZN	15	1
II	Biodiversity- Concept, Types, Hot spots; IUCN threat categories, Red data book, Causes and consequences of biodiversity loss: major threats to biodiversity- a. Habitat Loss & Alteration b. Exotic Species c. Chemical Pollutants d. Loss of Genetic Diversity; Different strategies for conserving biodiversity.	15	2
III	**Protozoa :** Classification, Locomotion, Nutrition and Reproduction. **Porifera:** Classification, Skeleton system, Canal system and Reproduction. Type study of Sycon.	20	3
IV	**Coelentrata:** Classification, Polymorphism, Mesentries in Coelentrata, Obelia	10	4
V	**Platyhelminthes & Nemathehelminthes:** Classification, type study- Liver fluke and Schistosoma. Life cycle and larval form of parasitic helminthes.	15	5

BOOKS SUGGESTED:

S. No.	Author	Book
1.	E. Mayer	Elements of Taxonomy
2.	G.G. Simpson	Principles of animal taxonomy
3.	R.C. Dalella& Verma	Taxonomy
4.	V.C. Kapoor	Taxonomy
5.	E.O. Wilson	Biodiversity
6.	E.J.W. Barrington	Invertebrate structure and function
7.	R.D. Barnes, Cecie Starr, Ralph Taggart, ChristineEvers, and Lisa Starr	Invertebrate Zoology

Integrated M.Sc. Semester – V

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	3	V

Course Code	Course Title	Course Type
ZL-501	Zoology Laboratory	**Core**

Credit	Hours Per Week (L-T-P)		
	L	T	P
5	-	-	10

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):

Develop awareness of sample types, preparation, and storage for molecular biology tests.A key goal of molecular genetics is to identify and study genetic mutations. Researchers search for mutations in a gene or induce mutations in a gene to link a gene sequence to a specific phenotype.Develop awareness

of sample types, preparation, and storage for molecular biology tests. Understand applicability of testing to various sample types.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Develop a strong foundation in the application of Bacterial Genetics Transformation, Conjugation, Transduction, Phage Titration, Transposition, α□ Complementation, Karyotyping.	An
2	Understand the Biodiversity in surrounding soil, air and water samples. Isolation of microflora and their morphological and microscopic characterization	An
3	Develop a strong foundation on general Molecular Biology Laboratory Procedures like DNA extraction, detection and amplification using PCR	AP
4	Develop expertise on Plasmid isolation and Purification, RE Digestion & Detection of the RE-digested product Using restriction mapping to teach basic skills in the molecular biology, Blunt□end cloning (after Ligation), Preparation of competent cells &Transformation of *E. coli* cells with plasmid	AP
5	A deep understanding on protein extraction & separation using polyacrylamide gel electrophoresis SDS-PAGE, Western blot analysis	AP

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	2	1	1	3	2	3	3	3	3	3	3	2	3
CO2	3	3	3	2	1	2	3	2	3	3	3	3	3	3	2	3
CO3	3	3	3	2	1	1	3	2	3	3	3	3	3	3	2	3
CO4	3	3	3	2	1	1	3	2	3	3	3	3	3	3	2	3
CO5	3	3	3	2	1	1	3	2	3	3	3	3	3	3	2	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: ZL 501 Zoology Laboratory

S.No.	Experiment	No. of Lab	CO No.
I	**Bacterial Genetics :** *E. coli* Transformation, Conjugation, Transduction Phage Titration, Transposition, α□ Complementation, Karyotyping	30	1
II	**Biodiversity :** Study of biodiversity of various vertebrates and invertebrates found in and around house and listing them and find out their zoological names. Identification, classification and study of distinguishing features of important representatives from various groups (Protozoa to Hemichordata) Study of permanent slides (Protozoa to Hemichordata) Study of biodiversity in grassland and pond ecosystem by using Shanon-weiner index	30	2
III	**General Molecular Biology Laboratory Procedures :** Extraction of genomic DNA Using Kit method & By conventional Ethanol Precipitation method, Detection of Nucleic acids (AGE), Polymerase Chain Reaction (PCR) & Detection of the PCR product and its purification	30	3

IV	**Plasmid isolation** and Purification, RE Digestion & Detection of the RE-digested productUsing restriction mapping to teach basic skills in the molecular biology, Blunt□end cloning (after Ligation), Preparation of competent cells & Transformation of *E. coli* cells with plasmid	30	4
V	**Protein extraction & separation** using polyacrylamide gel electrophoresis SDS-PAGE, Western blot analysis to illustrate relative control levels of the lac and ara promoters in *E. coli*	30	5

Integrated M.Sc. Semester – VI

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	3	VI

Course Code	Course Title	Course Type
Z-601	**Structure and Function of Invertebrates**	**Core**

Credit	Hours Per Week(L-T-P)		
	L	T	P
3	2	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):

The learning objectives for a course on " Structure and Function of Invertebrates " aim to studying invertebrates in comparative anatomy is crucial due to their variety of cells and tissues, which give insight into evolution and biodiversity. Their diverse body plans reflect how an organism's environment influences its structure

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Students will study the general characters and Classification of Annelida, Filter feeding in Polychaeta.	U
2.	Learners will study the general characters and classification of Arthropoda, different systems such as vision and respiration in Arthropoda Mouth parts of insects, Larval forms in crustacea, metamorphosis, insects and diseases, Social life in bees and termites	U
3.	Students will study the general characters and classification of mollusca, and different systems	An
4.	Students will study the general characters and classification of Echinodermata, skeleton in Echinodermata, Affinities with Chordates	U
5.	Students will study the general characters of Minor Phyla- Ectoprocta & Endoprocta; Hemichordate	U

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	-	-	-	-	3	-	-	3	3	3	3	2	2	3
CO2	3	3	-	-	-	-	3	-	-	3	3	3	3	2	2	3
CO3	3	3	-	-	-	-	3	-	-	3	3	3	3	2	2	3
CO4	3	3	-	-	-	-	3	-	-	3	3	3	3	2	2	3
CO5	3	3	-	-	-	-	3	-	-	3	3	3	3	2	2	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"NoCorrelation

Detailed Syllabus: Z-601 Structure and Function of Invertebrates

Unit No.	Topics	No. of Lectures	CO No.
I	General characters, Classification of Annelida, Metamerism, Coelom, Coelomoducts, Nepheridia, Filter feeding in Polychaeta,	9	1
II	General characters, Classification of Arthropoda, Vision and Respiration in Arthropoda Mouth parts of insects, Larval forms in crustacea, metamorphosis, insects and diseases, Social life in bees and termites	9	2
III	General characters, Classification of mollusca, Respiration, Torsion and Detorsion, Foot and Nervous system in Mollusca, Pearl formation, Trocophore larvae	9	3
IV	General characters, Classification, Water-vascular system in Asteroidea Larval forms in Echinodermata, skeleton in Echinodermata, Affinities with Chordates	9	4
V	General characters of Minor Phyla- Ectoprocta & Endoprocta; Hemichordate	9	5

BOOKS SUGGESTED:

S. No.	Author	Books
1.	Linda S. Costanzo	Physiology: Board Review Series
2.	L.H. Hyman R.D. Barnes	The Invertebrate Vol. 1& 2
3.	A. Sedgwick	A student text book of Zoology
4.	T.J. Parker & W.A. Haswell	Text Book of Zoology-
5.	W.D.Russell -Hunter	Invertebrate Zoology- Biology of higher Invertebrate-
6.	E.J.W. Barrington	Invertebrate structure and function –
7.	William Ganong	Review of Medical Physiology (Lange BasicScience)
8.	Guyton and Hall	Physiology Review
9.	Appleton and Lange	Review of Physiology
10.	Linardakis	Illustrated review of Physiology

Integrated M.Sc. Semester – VI

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	4	VII

Course Code	Course Title	Course Type
Z-602	Vertebrates	Core

Credit	Hours Per Week(L-T-P)		
	L	T	P
4	3	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):

The learning objectives for a course on "Vertebrates" aim to provide students with a comprehensive understanding of the diversity, anatomy, physiology, behavior, and ecological roles of vertebrate animals. Students will explore the evolutionary history and phylogenetic relationships of vertebrates.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Students will understand the origin and adaptive radiation of chordates, including fishes, amphibians, reptiles, birds, and mammals. They'll outline the classification of chordates and analyze the evolution of early vertebrates	U
2.	Learners will classify and recognize key features of fishes and amphibians, including aspects like neoteny, parental care, and migration patterns in fish.	U
3.	Students will classify and identify characteristics of reptiles, including Mesozoic reptiles and living reptile groups like chelonia, crocodilia, and squamata. They'll explore the evolutionary significance of dinosaurs and Archaeopteryx.	E
4.	Learners will classify birds, understanding flight adaptations, migration patterns, and beak morphology. They'll compare skeletal systems and the evolution of the urinogenital system in vertebrates.	U
5.	Students will classify mammals, including prototheria and metatheria, and explore the evolution of the placenta. They'll analyze the adaptive radiation of mammals and understand Cenozoic mammalian diversity.	An

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	-	1	-	-	2	-	1	3	3	3	3	1	1	3
CO2	3	3	-	1	-	-	2	-	1	3	3	3	3	1	1	3
CO3	3	3	-	1	-	-	2	-	1	3	3	3	3	1	1	3
CO4	3	3	-	1	-	-	2	-	1	3	3	3	3	1	1	3
CO5	3	3	-	1	-	-	2	-	1	3	3	3	3	1	1	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"NoCorrelation

Detailed Syllabus: Z 602 Vertebrates

Unit No.	Topics	No. of Lectures	CO No.
I	Origin and adaptive radiation of chordates- Fishes, Amphibia, Reptiles, Aves & Mammals. Outline Classification of the Chordates, Origin and Evolution of Agnatha: Ostracoderms and Cyclostomes and early gnathostomes (Placoderms), Phylogeny of Vertebrates	15	1
II	Classification and characteristic features of Pisces, Classification and characteristic features of Amphibia; Neoteny and Paedogenesis; Parental care; Fish Migration	10	2
III	Classification and characteristic features and affinities of Reptiles; Mesozoic reptiles, Dinosaurs; Living reptiles; Rhynchocephalia; Chelonia, Crocodilia and Squamata; Archaeopteryx	10	3
IV	Classification, characteristic features and affinities of Aves; Flightless birds ; Origin of flight, Flight Adaptation; Migration; Types of beaks and palate in birds. Skeletal system- Comparative account of Skull, vertebrae, limbs and girdles. Evolution of Urinogenital system in vertebrates.Comparative account of urinogenital system in vertebrates.	15	4
V	Classification, characteristic features, affinities and adaptive radiation of Mammals (Prototheria and Metatheria); Evolution of Placenta; Cenozoic Mammals.	10	5

BOOKS SUGGESTED:

S.No.	Author	Book
1.	J.Z. Young	Anatomy of Life of the vertebrate
2.	A.S. Romer	Vertebrate body
3.	E.H. Colbert	Evolution of vertebrate
4.	C.G. Kent	Comparative anatomy of Vertebrate

Integrated M.Sc. Semester – VI

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	3	VI

Course Code	Course Title	Course Type
Z-603	**Animal Physiology**	**Core**

Credit	Hours Per Week(L-T-P)		
	L	T	P
4	3	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):

The learning objectives for a course on "Animal Physiology" aim to provide students with a comprehensive understanding of the physiological mechanisms underlying the functioning of animal organisms. Students will explore the principles of homeostasis, cellular metabolism, and regulatory systems such as the nervous, endocrine, and immune systems. They will analyze the integration of physiological processes across various organ systems to maintain health and respond to environmental challenges.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Students will understand cellular structure, metabolism, and mechanisms of homeostasis. They'll explore body control systems, including the hypothalamic/pituitary axis and circadian rhythms.	U
2.	Learners will comprehend neuron function, synaptic transmission, and central nervous system design, including sensory perception and autonomic nervous system regulation.	U
3.	Students will study and understand the mechanism of endocrine system .	U
4.	Learners will understand the muscular and respiratory physiology and control mechanisms, as well as energy balance and metabolism in both plants and animals.	U
5.	Students will explore the digestive and excretion processes, salt and water balance, and examples of physiological disorders such as diabetes. They'll engage in comparative physiology to understand biological adaptations across species.	An

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	Pos											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	-	-	-	-	3	-	-	3	3	3	3	2	2	3
CO2	3	3	-	-	-	-	3	-	-	3	3	3	3	2	2	3
CO3	3	3	-	-	-	-	3	-	-	3	3	3	3	2	2	3
CO4	3	3	-	-	-	-	3	-	-	3	3	3	3	2	2	3
CO5	3	3	-	-	-	-	3	-	-	3	3	3	3	2	2	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"NoCorrelation

Detailed Syllabus: Z 603 Animal Physiology

Unit No.	Topics	No. of Lectures	CO No.
I	Cell Structure & Metabolism: Homeostasis, Mechanisms of Cellular Control, Membrane Transport, Membrane Potentials (a review). Body Control: Hypothalamic/Pituitary Axis, Mystic Rhythms	8	1
II	Neurons and the Nervous system: Synapses, Sense Perception, Special Senses, CNS Design: Autonomic Nervous System, Action Potential, □ Basic structures of neurons and glia, Neurotransmission: Ion channels, Membrane potentials, Resting potential – Depolarization, repolarization and hyperpolarization. Electrotonic and Action potential, Mechanism of neurotransmission. Membrane channels –voltage gated, ligand gated, mechanically gated. Basics of a synapse (electrical and chemical). Introduction to central nervous system design: Structural and functional outline of the brain and the spinal cord, Hypothalamus: Osmoregulation, temperature control, and role in neuroendocrine system: Hypothalamus□hypophyseal portal system, Autonomic Nervous System (sympathetic and parasympathetic pathways). Reflex action.	20	2
III	Endocrine system – Secretion and functions of hormones of thyroid, pituitary and gonads. Role of hormones in reproduction. Mechanism of action of hormones	12	3
IV	Muscular system: Skeletal Muscle, Muscle Characteristics, Muscle Control, Muscle Exercise, Smooth Muscle. Cardiovascular Systems: Cardiac Muscle, Heartbeat , Cardiac Control, Blood: Hemostasis, Temperature Control, Vessels, Tissue Exchange, EKGs and Blood Pressure., Respiratory Systems: Respiration, Respiratory Control. Energy Balance and Metabolism: Fuel Metabolism	10	4

V	Digestion system: Composition, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions. Digestion and absorption of carbohydrates, lipids, proteins, & nucleic acids. Excretory System- Structure of nephron, glomerular filtration, tubular reabsorption of glucose, water and electrolytes. Tubular secretion. Homeostatic regulation of water and electrolytes, Acid-base balance. Diabetes, Comparative Physiology	10	5

BOOKS SUGGESTED:

S. No.	Author	Books
1.	Linda S. Costanzo	Physiology: Board Review Series
2.	William Ganong	Review of Medical Physiology (Lange BasicScience)
3.	Guyton and Hall	Physiology Review
4.	Appleton and Lange	Review of Physiology
5.	Linardakis	Illustrated review of Physiology

Integrated M.Sc. Semester – VI

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	3	VI

Course Code	Course Title	Course Type
Z-604	**Biology of Parasitism**	**Core**

Credit	Hours Per Week(L-T-P)		
	L	T	P
3	2	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):

The learning objectives for a course on the "Biology of Parasitism" aim to provide students with a comprehensive understanding of the ecological, evolutionary, and biomedical aspects of parasitic relationships. Students will explore the diversity of parasitic organisms, including protozoa, helminths, and arthropods, and their interactions with hosts.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Students will grasp the importance of microbial communities in human health, understand the transmission of infectious agents and vectors of diseases, and analyze the mechanisms by which human pathogens establish diseases.	U
2.	Learners will explore the history and scope of microbiology, including bacteriology, with a focus on bacterial morphology, classification, ultrastructure, reproduction, metabolism, and diseases caused by bacteria such as tuberculosis	U
3.	Students will examine protozoan, helminth, and fungal diseases, understanding their transmission, host-parasite relationships, and impacts on human and animal health, including diseases transmitted by ticks and insects.	E
4.	Learners will analyze the interactions between animals and microbes, including adverse, mutualistic, and commensal relationships, as well as the cellular, biochemical, and genomic basis of microbial colonization, infection, and pathogenesis in animals.	An

5.	Students will understand the principles and methods of physical and chemical control of microbes, including sterilization, disinfection, and antimicrobial therapy. They'll explore antimicrobial classification, modes of action, resistance, and their implications for public health.	U

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	Pos											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	1	-	-	-	3	-	1	3	3	3	2	2	3	3
CO2	3	3	1	-	-	-	3	-	1	3	3	3	2	2	3	3
CO3	3	3	1	-	-	-	3	-	1	3	3	3	2	2	3	3
CO4	3	3	1	-	-	-	3	-	2	3	3	3	2	2	3	3
CO5	3	3	1	-	-	-	3	-	2	3	3	3	2	2	3	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"NoCorrelation

Detailed Syllabus: Z 604 Biology of Parasitism

Unit No.	Topics	No. of Lectures	CO No.
I	Biodiversity and their function: Importance of the communities of microorganisms thatinhabit the human body. Transmission of infectious agent; Vectors of human diseases.Human Pathogens and their mechanism of disease establishment, Micobiome and Immunity and their role in protection from pathogens, Cross-Talk Between Gut Microbiome and Host Metabolism Under Normal Physiological Condition.	9	1
II	Microbiology History and scope of microbiology, Bacteriology: Morphological classification, classification based on staining reaction, Ultrastructure of bacteria, Reproduction, Metabolism- Energetics, metabolic pathways, Economic importance, Mycoplasma and Actinomycetes-General account, bacterial disease (Tuberculosis)	9	2
III	Protozoan diseases (Amoebiasis, Malaria, Giardiasis, Trypanosomiasis, Coccidiasis), Parasites of domestic animals, Host-parasite relationship,Helminth parasites and diseases (Taeniasis, Schistosomiasis), nematodes parasites and diseases (Ascariasis, Filariasis), Fungal diseases (Mycosis, Mycotoxicosis), disease transmitted by ticks and insects (Lyme disease, Rickettsiae).	9	3
IV	Animal Microbe interaction: Adverse, mutualistic and commensal relationships between animals and microbes with examples, Cellular, Biochemical and genomic basis of microbial colonization, Infection and pathogenesis in animals, Overview on drugs and therapeutics, bacteriocide, antibiotics, antibiotic resistance, fungicide, mode of action.	9	4
V	Physical and chemical control of microbes. Principles of antimicrobial therapy: Various methods of control of microorganisms: physical, chemical and biological. Different methods of Sterilization- moist heat sterilization, Dry heat sterilization, Filter sterilization of thermolabile substances and air, chemical sterilization, Disinfection, and antisepsis, Antimicrobials, classification and modes of action. Antimicrobial resistance and their impact.	9	5

BOOKS SUGGESTED:

S.No.	Author	Book
1	S.A.J. Tarr (1972)	Principles of Plant Pathology. Macmillan International Higher Education
2	T. V. R. Pillay [Ed.]. (1972)	Coastal Aquaculture in the Indo Pacific Region, FAO.
3	T. V. R. Pillay and Dill W. A. [Eds.] (1979)	Advances in aquaculture fishing. Fishing News Books.
4	Vita I.D. [Ed.] (1993).	Freshwater pond culture and management. Scientific Publishers, Jodhpur

Integrated M.Sc. Semester – VI

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	3	VI

Course Code	Course Title	Course Type
II-601	**Ethics of Science and IPR**	**Core**

Credit	Hours Per Week(L-T-P)		
	L	T	P
2	2	0	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):

To introduce basic concepts of ethics and safety that is essential for Life Science Labs. To understand the procedures involved in protection of Intellectual property. To give an insight into different treaties signed. To gain knowledge about patent filing. The Intellectual Property Rights have two main objectives, firstly to promote the creation of intellectual property by providing incentives and secondly to promote the dissemination of the knowledge in intellectual properties by affording protection to its creators.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Identify and analyze an ethical issue in the subject matter under investigation or in a relevantfield. Identify the multiple ethical interests at stake in a real-world situation or practice.	U
2.	Analyze several contemporary ethical issues that arise in the practice of medicine from multiple perspectives, including that of medical professionals, patients and society in general	An
3.	Identify criteria's to fit one's own intellectual work in particular form of IPRs	E
4.	A patent provides a limited-term exclusive right to produce and market an invention inexchange for detailed information about that invention	Ap
5.	Distinguish and Explain various forms of IPRs	E

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	2	2	1	2	1	3	2	2	3	1	2	2	3
CO2	3	3	3	2	2	1	2	1	3	2	2	3	1	2	2	3
CO3	3	3	3	2	2	1	2	1	3	2	2	3	1	2	2	2
CO4	3	3	3	2	2	1	2	1	3	2	2	3	1	2	2	2
CO5	3	3	3	1	2	1	2	1	3	2	2	3	1	2	2	2

"3"–Strong;"2"–Moderate;"1"-Low;"-"NoCorrelation

Detailed Syllabus: H 601 Ethics of Science and IPR

Unit No.	Topics	No. of Lectures	CO No.
I	Introduction to Ethics– causes of unethical acts, Definition – moral, values, ethics; Role and importance of ethics in science; Professional ethics – professional conduct, Teaching ethical values to scientists, good laboratory practices, good manufacturing practices, Basic Approaches to Ethics; Posthumanism and Anti Posthumanism.	6	1
II	Medical Ethics: Different themes pertaining to medical ethics including ethical issues in public health. Environmental Ethics, Bioethics, Journals and Publishers: Monopolistic practices by Academic Publishers. Plagiarism, softwares for plagiarism detection.	6	2
III	Introduction to IPR; Types of Intellectual property – Patents, Trademarks, Copyrights and related rights; Traditional vs. Novelty; Importance of intellectual property rights in the modern global economic environment, Importance of intellectual property rights in India.	6	3
IV	Patents: Definition, patentable and non patentable inventions; types of patent application – Ordinary, Conventional, PCT, Divisional, and Patent of addition; Concept of Prior Art; Precautions while patenting disclosure / nondisclosure;	6	4
V	Case studies and agreements Evolution of GATT and WTO and IPRprovisions under TRIPS; Madrid agreement; Hague agreement; WIPO treaties; Budapest treaty; Indian Patent Act (1970)	6	5

BOOKS SUGGESTED:

S. No.	Author	Book
1	David B. Resnik	The Ethics of Science: An Introduction', Routledge, New York, 1998
2	V. K. Ahuja	Intellectual Property Rights in India', 2015
3	V. K. Ahuja	Law Relating to Intellectual Property Rights', 2017.

Integrated M.Sc. Semester – VI

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	3	VI
Course Code	**Course Title**		**Course Type**
ZL-601	Zoology Laboratory		**Core**

Credit	Hours Per Week (L-T-P)		
	L	T	P
3	-	-	6

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):

After completing the course the students should be able to: Use their knowledge about organs, organ structure and different cell types to explain and describe the specialized functions and regulations of the major organs and organ systems in the animal kingdom. Animal physiology examines how biological processes function, how they operate under various environmental conditions, and how these processes are regulated and integrated. Explain the basic genetic systems of bacteria, bacteriophage and plasmids.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Students will learn basic techniques of blood group testing and determining blood pressure.	An
2	Develop expertise on various immunological assays like Differential Leucocyte count, Ag detection & Ab detection, Double diffusion, Radial Immunodiffusion, Total serum protein estimation, Estimation of glammaglobulins in serum, Determination of A:G ratio in serum sample	An
3	learn the techniques of media preparation and microbial culture method.	An
4	Acquire hands on experience in isolation and growth curve estimation along with mean generation time of microbes.	An
5	Ability to characterize microbes based on their ability to antibacterial sensitivity, fermentation test, Catalase activity and Amylase activity	An

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	1	3	2	1	3	1	2	3	3	3	3	3	2	3
CO2	3	2	1	3	2	1	3	1	2	3	3	3	3	3	2	3
CO3	3	2	1	3	2	1	3	1	2	3	3	3	3	3	2	3
CO4	3	2	1	3	2	1	3	1	2	3	3	3	3	3	2	3
CO5	3	2	1	3	2	1	3	1	2	3	3	3	3	3	2	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: ZL601 Zoology Laboratory

S. No.	Experiment	No. of Lab	CO No.
I	**Animal Physiology** a) Determine the blood pressure of man. b) Estimation of RBC, hemoglobin, blood group and Rh factor. c) Determination of urea, glucose and ketone bodies in urine.	18	1

II	Identification, classification and study of dintinguishing features of important representatives, museum specimens, slides or photographs of vertebrates Comparative study of integumentary, skeleton and reproductive system of major vertebrates.	18	2
III	**Microbiology** Media Preparation: Preparing and inoculating solid and liquid nutrient media for culturing microorganisms: Preparing nutrient media, Pouring nutrient agar plates and streaking bacterial culture on solid media, Inoculating nutrient broth with bacterial culture	18	3
IV	**Microbiology** Growth Curve: Generating a bacterial growth curve under various pH and environmental conditions (steady and shaking); Calculations of Growth rate constant (μ); Calculation of generation time	18	4
V	c) Antibacterial activity testing d)Bacterial Fermentation test e)Isolation & Detection of coliform bacteria f) Catalase activity g) Amylase activity	18	5

Integrated M.Sc. Semester – VII

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	4	VII

Course Code	Course Title	Course Type
B-701	**Evolutionary Biology**	**Core**

Credit	Hours Per Week(L-T-P)		
	L	T	P
4	3	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):
To understand and apply basic principles of the origin of life especially prokaryotes as well as eukaryotes in detail. To understand detailed outline of extinctions and its types. To gain descriptive knowledge regarding Origin and Evolution of Man.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Studying the origin and earliest evolution of life, along with the long-term evolution of the Earth's environments, helps us understand why the Earth became habitable and why terrestrial life has persisted for billions of years	U
2.	Understanding the role of genetic mechanisms in evolution.	E
3.	In order to discern a particular critical aspect, learners must experience variation in the dimension of that aspect.	An

4.	Understand how the link between environment and evolution. Understand how we can determine whether or not a population is evolving for a specific character. Be familiar with the different agents of evolution.	Ap
5.	Students will be able to: identify the characteristics of primates. distinguish between humans and other primates. discuss three species of human ancestors	C

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	2	3	2	2	2	-	2	2	3	3	2	2	3
CO2	3	3	3	2	3	2	2	2	-	2	2	3	3	2	2	2
CO3	3	3	3	3	3	3	2	3	1	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	2	3	2	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	2	3	2	3	3	3	3	3	3	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: B 701 Evolutionary Biology

Unit No.	Topics	No. of Lectures	CO No.
I	Origin of life: Historical theories and background information, Experimental approaches, Chemogeny, Biogeny, RNA and DNA world, evolution of proteins, origin of photosynthesis, evolution of eukaryotes. Lamarckism, Darwinism, pre- Darwinian and post-Darwinian period, Neo-Darwinism. Theories of organic evolution. Evidences of evolution.	10	1
II	Sources of variations: Heritable variations and their role in evolution. Natural selection: types of natural selection (Directional, stabilizing and disruptive) and examples (Industrial melanism, Australian rabbits, resistant to pestiscides, heavy metal resistance in plants), Sexual selection, group and kin selection.	15	2
III	Polpulation genetics and evolution: Hardy-Weinberg Law (statement and derivation of equation, application of law to human Population); Evolutionary for cesup setting H-W equilibrium. Genetic Drift.(mechanism, founder's effect, bottleneck phenomenon); Role of Migration and Mutation in changing allele frequencies	10	3
IV	Evolution above species level: Adaptation, adaptive radiation, microevolution, macroevolution, megaevolution, punctuated equilibria and related phenomenon. Isolation: Introduction and types of isolation. Speciation: species concept, modes of speciation: allopatric, sympatric	15	4
V	Origin and evolution of man, Unique hominin characteristics contrasted with primate characteristics, primate phylogeny from Dryopithecus leading to Homo sapiens, Phylogenetic trees, Multiple sequence alignment, construction of phylogenetic trees.	10	5

BOOKS SUGGESTED:

S. No.	Author	Book
1.	S. Freeman and J.C. Herron	Evolutionary Analysis, 4th Edn., Benjamin-Cummings(2007)
2.	D.J. Futuyma	Evolution, 2nd Edn., Sinauer Associates Inc.(2009)

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Integrated M.Sc. Semester – VII

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	3	VI

Course Code	Course Title	Course Type
B702	Immunology	Core

Credit	Hours Per Week (L-T-P)		
	L	T	P
4	3	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):
It will provide understanding for the development of new therapies and treatments that can manage or cure the condition by altering the way the immune system is working or, in the case of vaccines, priming the immune system and boosting the immune reaction to specific pathogens.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Describe the purpose of the immune system. Identify the components of the immune system.Differentiate between the innate and adaptive immune response.	U
2.	To understand how the immune system develops, how the body defends itself against disease, and what happens when it all goes wrong.	E
3.	Explain the genetic events that lead to diversity of T-cell receptors. Compare and contrast thevarious classes and subtypes of T cells in terms of activation and function.	An
4.	Distinguish between an antigen and an antibody, describe the chemical structure of an antibody (immunoglobulin) protein, describe different mechanisms of how antibodies limit the effects of pathogens or toxins by opsonization, neutralization, agglutination, precipitation, lysis, and antitoxin action.	Ap
5.	Demonstrate the basic knowledge of immunological processes at a cellular and molecularlevel. Define central immunological principles and concepts.	C

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	2	3	2	3	2	2	2	2	3	3	2	2	3
CO2	3	3	3	2	3	2	3	2	2	2	2	3	3	2	2	3
CO3	3	3	3	3	3	2	3	3	2	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3

"3"–Strong;"2"–Moderate;"1"-Low;" "NoCorrelation

9.7.24

Detailed Syllabus: B702 Immunology

Unit No.	Topics	No. of Lectures	CO No.
I	Overview of the Immune system: Types of immunity, innate, acquired, passiveand active, self vs nonself discrimination, Adaptive immune response, Autoimmunity	12	1
II	Cells and organs of the immune system: T cell receptors, T cell receptor genes& gene rearrangements, T cell maturation, activation & differentiation, B cell generation, activation & development	12	2
III	Antigens and Antibodies: Immunoglobulins structure and function, Immunoglobulin genes Organization and rearrangement, Antibody diversity, Antigen antibody reactions, MHC (antigens and genes), Antigen processing & presentation	12	3
IV	Immune response: Self Non self discrimination (mechanism), Clonal selection theory & idiotypic network hypothesis, Cytokines, The complement system, Cell mediated effector response, Leukocyte migration and inflammation, Hypersensitive reactions, Immune regulation, Immune response to infectious organisms, Vaccines, Immunodeficiency diseases (AIDS)	12	4
V	Immunology & applications: Transplantation immunology, Tumour immunology, Immunotechnology, Animal models. Plant immunity	12	5

BOOKS SUGGESTED:

S. No.	Author	Book
1.	Goldsby, Kindt, and Osborne	Immunology
2.	Janice Kuby	Immunology
3.	Ivan Roitt	Essential Immunology, 8th Edition
4.	Cellular and Molecular Immunology	Kathyrn Austyn
5.	David	Biology of Immunological Diseases
6.	Richard Burry	Immunocytochemistry: A practicalguide for Biomedical Research

Integrated M.Sc. Semester – VII

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	4	VII

Course Code	Course Title	Course Type
B 703	**Imaging Technology in Biological Research**	**Core**

Credit	Hours Per Week (L-T-P)		
	L	T	P
4	3	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):
This paper gives an insight of different imaging techniques used in biological research.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Define and explain the propagation of light in conducting and non-conducting media; define and explain the physics governing laser behaviour and light matter interaction; apply wave optics and diffraction theory to a range of problems;	Ap
2.	Understand why and how the light microscope and electron microscope are used in biology	An
3.	Can analyze and understand NMR pulse sequences using basic NMR theory. master relevant academic tools and techniques in data recording and interpretation of NMRspectra.	E
4.	Imaging is a range of tests used to create images of parts of the body.	Ap
5.	Demonstrate the ability to use discipline specific research techniques.	C

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	2	3	3	3	2	1	3	2	3	3	2	2	2
CO2	3	3	3	2	3	3	3	2	2	3	2	3	3	2	2	2
CO3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: B 703 Imaging Technology in Biological Research

Unit No.	Topics	No. of Lectures	CO No.
I	The power of ten (understanding how small cells and the sub-cellular contents are). An introduction to light and optics, exploring with lenses (what are lenses, looking through them, understanding the concept of magnification, mirrors, angles of reflection, refraction, prisms and colors)	10	1
II	Fundamentals of illumination (ray diagrams, types of light sources, LEDs,power levels, coherence of light, elliptical reflectors) Exploring microscopes (short history, magnifying glass, simple and compound microscopes, electron Microscopes, stereomicroscope)	10	2
III	Fluorescence microscopy (Understanding fluorescence, Fluorescence protein technology, GFP, YFP), two-photon fluorescence microscopy, matrix assisted laser desorption/ionization mass spectrometry (MALDIMS) imaging	15	3
IV	Live cell imaging (confocal microscopes), Differential interference contrast (DIC) images Comparing Confocal and Widefield Fluorescence Microscopy, Atomic force microscopy and optical tweezers force spectroscopy	15	4
V	NMR Imaging Spatially nonresolved NMR spectroscopy; low-field NMR instruments; 1H-nuclear magnetic resonance (NMR) microimaging ; 1H-magic angle spinning NMR spectroscopy;	10	5

	MAS-13C NMR spectroscopy, Spectral-resolution enhancement using magic angle spinning.		

BOOKS SUGGESTED:

S. No.	Author	Book
1.	Ulf Grenander, Y Chow andDaniel M Keenan	Hands: A Pattern Theoretic Study of BiologicalShapes (Research Notes in Neural Computing) (Volume 2) Alberts *et al.*
2.	Valery V Tuchin, Lihong Wangand Dmitry A Zimnyakov	Optical Polarization in Biomedical Applications (Biological and Medical Physics,Biomedical Engineering)
3.	RM Lambrecht	Biological Models in Radiopharmaceutical Development (Developments in Nuclear Medicine)
4.	Philippe Sansonetti	Bacterial Virulence: Basic Principles, Models and GlobalApproaches (Infection Biology (VCH)
5.	Richard Nuccitelli, Leslie Wilson and Paul T Matsudaira	A Practical Guide to the Study of Calcium in Living Cells, Volume 40 (Methods in Cell Biology)

Integrated M.Sc. Semester – VII

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	4	VII

Course Code	Course Title	Course Type
Z-701	**Developmental Biology of Animals**	**Core**

Credit	Hours Per Week(L-T-P)		
	L	T	P
4	3	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):

The learning objectives for a course on "Developmental Biology" aim to provide students with a comprehensive understanding of the processes underlying the growth, differentiation, and morphogenesis of organisms from conception to adulthood. Students will explore the molecular, cellular, and genetic mechanisms regulating embryonic development, including fertilization, gastrulation, organogenesis, and tissue patterning. They will analyze the environmental and genetic factors influencing development and investigate the evolution of developmental processes across species.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Students will grasp the molecular mechanisms governing development, including transcription factors, morphogens, and cell fate determination. They'll understand how proliferation, apoptosis, and fate specification shape developmental processes.	An
2.	Learners will comprehend the biology of sex determination and differentiation, including spermatogenesis, oogenesis, fertilization, and ovulation in mammals.	U
3.	Students will compare early embryonic development across species, analyzing cleavage, gastrulation, and axis formation. They'll understand signaling cascades and molecular mechanisms underlying axis development.	U

4.	Learners will explore organogenesis in invertebrates, focusing on germ layer formation and regulation of somite, heart, kidney, and limb development. They'll study circulation changes, metamorphosis, and regeneration processes.	U
5.	Students will understand stem cell concepts, including totipotent, pluripotent, and multipotent cells. They'll explore sources and applications of stem cells in vertebrates, as well as developmental disorders, aging, and the role of genetic and environmental factors.	Ap

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	1	2	-	-	2	-	1	3	3	3	3	2	2	3
CO2	3	3	1	2	-	-	2	-	2	3	3	3	3	2	2	3
CO3	3	3	1	2	-	-	2	-	2	3	3	3	3	2	2	3
CO4	3	3	1	2	-	-	2	-	1	3	3	3	3	2	2	3
CO5	3	3	1	2	-	-	2	-	2	3	3	3	3	2	2	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"NoCorrelation

Detailed Syllabus: Z 701 Developmental Biology of Animals

Unit No.	Topics	No. of Lectures	CO No.
I	Basic concepts of molecular regulation of development: Transcription factors in differential gene expression; morphogens and axis formation; autocrine and paracrine regulation. How cell proliferation, apoptosis, and fate specification determine developmental processes.	10	1
II	Biology of sex determination, Biology of sex differentiation, Spermatogenesis, Oogenesis and vitellogenesis, Ovulation and ovum transport in mammals Fertilization-recognition of gametes, acrosome reaction, activation of egg metabolism	10	2
III	Comparative study of early embryonic development: (Caenorhabditis elegans, amphibians,birds, and mammals), Cleavage formation, Gastrulation Axis formation: Signaling cascades and molecular understanding of anteroposterior, mediolateral, and dorsoventral axes development.	10	3
IV	Organogenesis invertebrates: Germ layer formation. Regulation of formation of the somites, heart, kidney, blood vessels and limb. Changes in circulation pattern between fetus and newborn. Metamorphosis and regeneration process: Hormonal control of metamorphosis in amphibians and insects; wing imaginal disc formation in drosophila. Regeneration in planeria and that of vertebrate limb.	15	4
V	Stemcells: Concepts of totipotent, pluripotent, and multipotent cells. Factors regulating "stemness" of a cell. Embryonic vs. adult stem cells. Sources of stem cells in vertebrates and their applications. Developmental disorders and aging: Regulatory role of genetic and environmental factors. Role of carcinogens and teratogens.	15	5

BOOKS SUGGESTED:

S.No.	Author	Book
1.	Alberts *et al.*	Molecular Biology of the Cell
2.	SF Gilbert	Developmental Biology
3.	Lewin Benjamin	Gene VIII
4.	PO Moody	Introduction to Evolution, 1970
5.	Dobzhansky et al.	Evolution, W. H. Freeman. New York

Integrated M.Sc. Semester – VII

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	4	VII

Course Code	Course Title	Course Type
ZL-701	**Zoology Laboratory**	**Core**

Credit	Hours Per Week (L-T-P)		
	L	T	P
5	-	-	10

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):
Key goal of experiments is to understand and perform various immunological techniques. Study of developmental stages of animals and factors affecting their growth. Researchers also get the information of different bioinformatics tools and their applications.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Different immunological tests like SerumElectrophoresis, ELISA - direct &indirect, Widal – Tube &Slide, Immunoelectrophoresis, Rocket immunoelectrophoresis, VDRL	An
2	Animals and tissues for microtomy , Microscopic study and Microphotography	An
3	Preparation and examination of histological slides.	An
4	Comarision of homologous and analogous structures (legs and limbs of vertebrates)	An
5	A deep understanding bioinformatics tools sequence analysis using BLAST; sequence pattern, motifs and profiles. Prediction of secondary structure of proteins Prediction of tertiary structure (fold recognition, homology search) Molecular modeling and dynamics	AP

CL: Cognitive Levels (**R**-Remember; **U**-Understanding; **Ap**-Apply; **An**-Analyze; **E**-Evaluate; **C**-Create).

CO-PO/PSO Mapping for the course:

PO/ CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	1	2	3	2	3	3	3	3	2	3	3	3
CO2	3	3	3	3	1	2	3	2	3	3	3	3	2	3	3	3
CO3	3	3	3	3	1	2	3	2	3	3	3	3	2	3	3	3
CO4	3	3	3	3	1	2	3	2	3	3	3	3	2	3	3	3
CO5	3	3	3	3	3	2	3	-	3	3	3	3	2	3	3	3

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: ZL701 Zoology Laboratory

S. No.	Experiment	No. of Lab	CO No.
I	**Immunology :** a) Differential Leucocyte count b) Ag detection & Ab detection c) Double diffusion d) Radial Immunodiffusion e) Total serum protein estimation f) Estimation of glammaglobulins in serum g) Determination of A:G ratio in serum sample	15	1
II	Serum Electrophoresis, ELISA - direct &indirect, Widal – Tube &Slide, Immunoelectrophoresis, Rocket immunoelectrophoresis, VDRL	15	2
III	Animals and tissues for microtomy , Microscopic study and Microphotography Fixing of animal tissues , Washing , dehydration and De-alcoholization of tissues, Embedding of tissues , Block making , Trimming of blocks , Section cutting , Double staining, dehydration, clearing and mounting	15	3
IV	Examination of histological sections from permanent slides/microphotographs of rat and human-testis, epididymis and accessory glands of male reproductive system. Sections of ovary, fallopian tube, uterus	15	4
V	Comparison of homologous and analogous structures (legs and limbs of vertebrates) Study of permanent slides- thymus, lymph nodes, bone marrow	15	5

Integrated M.Sc. Semester – VIII

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	4	VIII

Course Code	Course Title	Course Type
B-801	**Virology**	**Core**

Credit	Hours Per Week (L-T-P)		
	L	T	P
4	3	1	-

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):
It will provide understanding of different types of viruses, their structure, mode of replication. It will also provideunderstanding of various therapies in case of viral infections.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Students will be able to comprehend the various Concepts regardingOrigin, archi nomencleture of the viruses. Replication mechanism and mode of transmission	U
2	Development of vaccines for the viral epidemics and also about antiviral chemotherapy.	L
3	Virus genetic structure and their mode of replication	U
4	Evolution of viruses and some serious infectious viruses such as HIV, Herpes and Pox virus	U
5	Study of bacteriophages, mode of replication and other infectious viruses	U

CL:CognitiveLevels(R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	2	3	2	2	2	2	2	2	3	2	2	2	3
CO2	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
CO3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
CO4	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: B -801: Virology

Unit No.	Topics	No. of Lectures	CO No.
I	Introduction to Virology: definition, properties and origin of viruses, Virus architecture and nomenclature, Virus replication cycle, Basic virological methods, Basics of virus entry, spread and transmission	12	1
II	Host resistance to viral infection: immune responses, Vaccines and antiviral chemotherapy: the prevention and treatment of viral diseases, Epidemiology, Exploiting viruses as gene therapy and vaccine vectors	15	2
III	Viruses and cancer: oncoviruses and oncolytic viruses, Polioviruses and other single-stranded positive-strand RNA viruses, Rabies and other single-stranded nonsegmented negative-strand, Influenza viruse and ther single-stranded segmented negative-strand RNA viruses.	12	3
IV	Evolution of viruses: new and reemerging viruses, Herpesviruses (nuclear large double-stranded DNA viruses), Poxviruses (cytoplasmic large double-stranded DNA viruses), HIV and other	10	4

	retroviruses		
V	Hepatitis B virus (reverse-transcribing DNA virus) and other viruses causing hepatitis, Prion diseases, Plant viruses, Bactériophages	11	5

Books Recommended:

S.No.	Author	Book
1	L Collier, J Oxford and Paul Kellam	Human Virology (4th edition),
2	SJ Flint, LW Enquist, VR Racaniello and AM Skalka	Principles of Virology (3rd edition) 2009
3	AJ Cann	Principles of Molecular Virology,
4	Teri Shors, Jones and Bartlett	Understanding Viruses
5	NJ Dimmock, A Easton, K Leppard	IntroductiontoModernVirology6thedition,

Integrated M.Sc. Semester – VIII

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	4	VIII
Course Code	Course Title		Course Type
B -802	BIOTECHNOLOGY-I		Core
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	3	1	0
Maximum Marks	CIA		ESE
100	60		40

Learning Objective (LO):
It will give an overview of the basic biotechnology techniques, rDNA technology, PCR, Blotting and plant tissueculture technique.

Course Outcomes (CO):-

CO No	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Students will have in –depth understanding of • Basic principles of genetic engineering. • Transgenic animals, cloning and applications • Development of transgenic plants and their applications.	U
2	Different molecular techniques such as library construction, vector designing etc.	L
3	Learning hybridization techniques, sequencing and gene transfer methods	L
4	Study of trangenics plants and animals and gene therapy	L
5	Tissue culture techniques, cloning , micropropagation techniques	L

CL:CognitiveLevels(R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	3	3	3	2	2	3	3	3	3	2	3	3
CO2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2

Detailed Syllabus: B -802: Biotechnology-I

Unit	Topics	No of lectures	CO
Unit-I	Basic concept of genetic engineering, Methods for creating recombinant DNA molecule, properties of restriction end onucleases and their mode of action, Cloning **Vectors**-Lambda phage, Plasmid, M13 phage, cosmid, yeast, viral and Expression vectors, YACs, BACs, PACs. Introduction of DNA into living cells and selection of recombinants.	10	1
Unit II	Construction of DNA library:Genomic libraries: Partial digest, choice of vectors, construction and evaluation of a genomic library, growing and storing libraries,cDNA Library: methods of generating cDNA library,Genomic vs cDNA library, Expression libraries	10	
Unit-III	Selection/screening: Analysis of genomic DNA by Southern hybridization, Northern and Western blotting techniques, Restriction mapping, DNA sequencing and analyses techniques, next gen sequencing, microarray technology. DNA manipulation techniques:Preparation of radiolabelled and synthetic probes, Amplification of DNA by polymerase chain reaction, Site directed mutagenesis, Gene transfer methods for animalsand plants	15	3
Unit-IV	Transgenic animals -Selectable markers, Reporter genes for promoter analysis, Embryonic stem cells, Super mouse,Pronuclear Transgenic Goats, Whole animal cloning e.g. Dolly, gene Knock-out, knock-down, knock- in technology, Gene therapy e.g. SCID] Agrobacterium mediated transformation in plants, Ti plasmid.	10	4
Unit-V	Cell and tissue culture in animals: Primary culture; Cell line; Cell clones; Callus cultures; Somaclonal variation; Micropropagation; Somatic embr genesis; Haploidy; somatic hydridization; Cybrides; Hybridoma technology.	15	5

Books Recommended:

S.No.	Author	Book
1	Benjamin Lewin	Gene VII, Oxford Publishers
2	T A Brown	Genome, Second edition,
3	Old and Primrose	Principles of Gene Manipulation;
4	Simmons and Gardner	Principles of genetics;
5	Donald Voet and Judith Voet	Biochemistry 3rd Edition,
6	T D.Watson and others	Molecular Biology of the Gene , 6th Edition

7	GM Cooper	The Cell: A molecular approach: Library ofCongress cataloging in publication data.
8	Griffiths A and Miller J	Anintroductiontogeneticanalysis;Freeman
9	Lodish H and Berk	A Molecular cell biology;
10	Sambrook J, Russell	Molecular cloning: Vol I, II , III; CSHL Press
11	TA Brown	Gene cloning and DNA analysis;
12	BGlick,JPasternak&CPatten	Molecular Biotechnology principles and applications of Recombinant DNA, 4th
13	K. Deb and Satish Totey	Stem Cells Basics and Applications;
14	Gary Stein and Maria B et al.	Human Stem Cell Technology and Biology;

Integrated M.Sc. Semester – VIII

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	4	VIII
Course Code	Course Title		Course Type
B -803	**BIOINFORMATICS**		**Core**
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	3	1	0
Maximum Marks	CIA		ESE
100	60		40

Learning Objective (LO):
It will give an overview of fundamentals of bioinformatics, databases and different tools BLAST FASTA.Application of these tools for understanding biological molecules.

Course Outcomes(CO):-

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Students will have in –depth understanding of History, definition, importance and applications of Bioinformatics, Bioinformatics and computational Biology opportunities in India. Major Bioinformatics Resources	L
2	Introduction of Biological Database	L
3	Basics and techniques of alignment, Phylogenetic Analysis, Algorithms /methods of phylogenetic analysis	L
4	Protein structure analysis and prediction, Fundamentals of the methods for 3D structure prediction, sequence similarity/identity of target proteins of known structure, fundamental principles of protein folding	Ap
5	Genomics and Functional Analysis Methodologies for high throughput analysis including, Drug discovery and Development, Applications of Bioinformatics,	Ap

CL:CognitiveLevels(R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	3	3	3	3	1	3	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
CO3	3	3	3	3	3	3	3	3	1	3	3	3	3	3	3	1
CO4	3	3	3	3	3	3	3	3	1	3	3	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	1

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: B 803 Bioinformatics

Unit No	Topics	No of lecture	CO
Unit-I	Introduction to Bioinformatics: Bioinformatics - History, definition, importance and applications of Bioinformatics, Bioinformatics and computational Biology opportunities in India. Major Bioinformatics Resources: NCBI, EBI, ExPaSy	10	1
Unit II	Biological databases- Introduction of Biological Databases; (a) Nucleic acid databases (NCBI, DDBJ, and EMBL). (b) Protein databases (Primary, Composite, and Secondary)(c) Specialized Genome databases: (SGD, TIGR, and ACeDB) (d) Structure databases (CATH, SCOP, & PDBsum)	10	
Unit-III	Alignment: Basics and techniques, Local alignment and Global alignment, Pairwise sequence alignment:NEEDLEMAN and Wunsch algorithm, Smith and Waterman algorithm, The Dot Plot.Multiple Sequence Alignment (MSA): Definition, Objective, Methods for MSA: Heuristic approach, Dynamic programming approach and their combinations. database similarity searches- BLAST/FASTA algorithms, Phylogenetic Analysis: Phylogenetic-trees, Terminology of tree- reconstruction, rooted and un rooted trees, gene vs species trees and their properties. Algorithms /methods of phylogenetic analysis: UPGMA, Neighbor-Joining Method.	15	3
Unit-IV	Protein structure analysis and prediction: Identification/assignment of secondary structural elements from the knowledge of 3 D structure of macromolecule using DSSP and STRIDE methods , Prediction of secondary structure: PHD and PSI PRED method Tertiary (3 D) Structure prediction: Fundamentals of the methods for 3D structure prediction (sequence similarity/identity of target proteins of known structure, fundamental principles of protein folding etc.)	15	4
Unit-V	Genomics and Functional Analysis Methodologies for high throughput analysis including NGS, application of bioinformatics in genomics. Comparative genomics. Drug discovery and Development : Introduction to Drug Design and Development, Drug targets, Lead Identification and Modification, Computer- Aided Drug Design, Drug Delivery, Applications of Bioinformatics: Pharmaceutical industries, immunology, agriculture, forestry; Legal, ethical and commercial ramifications of bioinformatics.	10	5

Books Recommended:

S.No.	Author	Book
1	E Wayne W Daniel	BiostatistiCs:AfoundationforAnalysisintheHealthSciences
2	Prem S Mann	Introductory Statistics. 5th Edition;
3	Olive Jean Dunn	Basic Statistics: A primer for Biomedical Sciences
4	C Stan Tsai,	Computational Biochemistry;

9.7.24

5	SC Rastogi *et al.*,	Bioinformatics Methods and Applications
6	A Caldwell et al.,	Integrated Genomics; Wiley Publishers

Integrated M.Sc. Semester – VIII

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	4	VIII
Course Code	Course Title		Course Type
B -804	**BIOTECHNOLOGY II**		**Core**
Credit	Hours Per Week (L-T-P)		
	L	T	P
4	3	1	0
Maximum Marks	CIA		ESE
100	60		40

Learning Objective (LO):
It will give an overview of industrial, medical, environmental biotechnological processes. It will also provideconcept regarding ethical concerns of GM crops.

Course Outcomes (CO):-

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Principles of plant breeding, Important conventional methods, Ethics of GMcrops and animal cloning, Plant diseases and defensive mechanisms,	U
2	Bioprocess Technology, basics of bioreactor kinetics and mathematical equations,Kinetics of microbial growth Solid state fermentation.	U
3	Industrial Biotechnology, Biopolymers	L
4	Remediation and Biotechnology their health effects, Solid waste management ,Environmental and industrial pollution control	U
5	Medical Biotechnology, Tissue Engineering and applications, Biomaterialsandapplications, Introduction to nanotechnology and nano-biotechnology, Nanomaterials and their uses.	Ap

CL:CognitiveLevels(R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	3	3	3	2	2	3	3	3	3	2	3	3
CO2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: B 804: Biotechnology-II

Unit No	Topics	No of lectures	CO
Unit-I	Principles of plant breeding: Important conventional methods of breeding self and cross pollinated and vegetatively propagated crops; Non conventional methods; Polyploidy: Genetic variability; Plant diseases and defensive mechanisms. Ethics of GM crops and animal cloning. Model organisms - S. cereviceae, Dictostylium, Caenorhabditis elegans, Arabidopsis, Zebra Fish, Mouse, Drosophila	10	1
Unit II	Industrial Biotechnology-I Bioprocess Technology [basics of bioreactor kinetics and mathematical equations regarding bioreactors, scale-up and aeration of bioreactors in detail, Kinetics of microbial growth, substrate utilization and product formation: Batch, Fed- Batch and continuous processes, Scale up concepts with respect to fermenter design and product formation, Gas exchange and mass transfer: O2 transfer, critical oxygen concentration, determining the oxygen uptake rate, Solid state fermentation.	15	2
Unit-III	Industrial Biotechnology-II Downstream Processing - Flocculation and floatation, Filtration, Centrifugation, Cell disruption, Liquid extraction, Precipitation, Adsorption, Dialysis, Reverse osmosis, Chromatography, Crystallization and drying, Common examples: Biopolymers	10	3
Unit-IV	Remediation and Biotechnology- Biodegradation of xenobiotic compound. Priority pollutants and their health effects, Microbial basis of biodegradation, Bioremediation (phyto and metal), Environmental and industrial pollution control, Biopesticides, Microbial plastics, Solid waste management	10	4
Unit-V	Medical Biotechnology-a. Production of small biological molecules, Tissue Engineering -Growth Factors and morphogens: signals for tissue engineering and whole organ development, extracellular Matrix: structure, function and applications to tissue engineering, Cell adhesion and migration, Inflammatory and Immune responses to tissue engineered devices b. Biomaterials -Polymeric scaffolds, Bio mimetic materials, Nanocomposite scaffolds Introduction to nanotechnology and nano-biotechnology, Nanomaterials and their uses.	15	5

Books Recommended:

1	R.IanFreshney,GlynN.Stacey, Jonathan M. Auerbach	Culture of Human Stem Cells. John Wiley &Sons
2	BernardRGlick,JackJPasternak, Cheryl L Patten	Molecular Biotechnology: Principles and Applications of Recombinant DNA. ASM Press
3	Robert Lanza, Robert Langer, Joseph P Vacanti	Principles of Tissue Engineering
4	F Gilbert	Developmental Biology; 6th Edition;
5	Gordana Vunjak Novakovic, R Ian Freshney	Culture of Cells for Tissue Engineering;
6	SB Primrose and Twyman	Principles of gene manipulation
7	RW Old and SB Primrose	Principles of gene manipulation

Integrated M.Sc. Semester – VIII

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	4	VII

Course Code	Course Title	Course Type
ZL-801	**Zoology Laboratory**	**Core**

Credit	Hours Per Week (L-T-P)		
	L	T	P
5	-	-	10

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):
key goal of experiments is to understand and perform various techniques to for the synthesis and application of nanoparticles. Extraction and estimation of phytochemicals and applications of different bioinformatics tools. s

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Learning the techniques for creating recombinant DNA molecule, restriction endonucleases and their mode of action	AP
2	Learning the transduction and cloning technique .	AP
3	Applications of different bioinformatics tools to retrieve the data from different biological databases	An
4	Molecular modeling and dynamics: using small oligonucleotides and small protein with known crystal structure (available from data bank),	AP
5	Drug designing – using available data Applications of bio informatics, Primer designing.	An

CL:CognitiveLevels(R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO / CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	2	2	1	2	1	-	2	2	3	1	2	-	3
CO2	3	3	3	2	2	1	2	1	-	2	2	3	1	2	-	3
CO3	3	3	3	2	2	1	2	1	-	2	2	3	1	2	-	3
CO4	3	3	3	2	2	1	2	1	-	2	2	3	1	2	-	3
CO5	3	3	3	2	2	1	2	1	-	2	2	3	1	2	-	1

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: BL 801 Zoology Laboratory

S. No.	Experiment	No. of Lab	CONo.
I	Performing Recombinant DNA technology restriction endonucleases experiments .	30	1
II	Performing the transduction and molecular cloning technique .	30	2
III	Applications of different bioinformatics tools to retrieve the data from different biological databases	30	3
IV	Molecular modeling and dynamics: using small oligonucleotides and small protein with known crystal structure (available from data bank).	30	4
V	**Bioinformatics:** DNA sequence analysis using BLAST; sequence pattern, motifs and profiles. Prediction of secondary structure of proteins Prediction of tertiary structure of (fold recognition, homology search) Molecular modeling and dynamics: using small oligonucleotides and small protein with known crystal structure (available from data bank), Drug designing – using available data Applications of bio informatics, Primer designing.	**30**	5

Integrated M.Sc. Semester – IX

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	5	IX
Course Code	Course Title		Course Type
ZPGD901	Zoology **PG Dissertation/ Project**		**Core**
Credit	Hours Per Week (L-T-P)		
	L	T	P
20	-	-	-
Maximum Marks	CIA		ESE
400	-		400

Scheme for evaluation of Project/Dissertation work for 9th semester CBS

The Center for Basic Sciences (CBS) offers 5 Year Integrated M.Sc. program (total credits-240) in subject Zoology. The complete program is for duration of 10 semesters. Each semester from 1-VIII carries 25 credits and semester IX to X will carry 20 credits each. As per the course structure of Int M.Sc. 9th semester, students have to carry out a project/Dissertation in their respective subjects for successful completion of the program. The project has to be carried out in recognized National/State laboratories/Institute/Universities.

The proposed evaluation scheme for Integrated M.Sc. 9th semester projects/Dissertation in subject Zoology (ZPGD 901) is as follows:

1		Marks
2	Project/Dissertation (certified by the supervisor of the Institute)	150
3	Seminar based on Project/ Dissertation	150
	Viva-Voce based on Project report/ Dissertation and Seminar	100
	Total Marks	400

The valuation of all the projects/Dissertation will be done by the external examiner, internal examiner of therespective subjects and Director (CBS) or nominee of the Director.

Integrated M.Sc. Semester – X

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	5	X

Course Code	Course Title	Course Type
BE1001	**Proteomics and Genomics**	**Elective**

Credit	Hours Per Week (L-T-P)		
	L	T	P
5	4	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):
It will give understanding on identifying the structures of proteins and biological functions of specific individual proteins, their cellular activities separation techniques, whole protein interaction networks. Genomics will give understanding of altering a genome with unparalleled efficiency and precision. Genomics is fostering an appreciation for what our DNA means for our health, identities and culture.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Introduction and scope of proteomics, Protein separation techniques	U
2.	Introduction to spectrometry and its applications ; Strategies for protein identification; Proteinsequencing; Applications of proteome analysis	U
3.	Protein-protein interaction, Protein engineering; Clinical and biomedical application of proteomics; Proteome database; Proteomics industry.	E
4.	Introduction and Classification of genomics; Methods of preparing genomic DNA; Genomesequencing methods (next-generation sequencing); Databases of genomes; Genetic mapping;	U
5.	Gene variation and Single Nucleotide Polymorphisms (SNPs); Expressed sequenced tags(ESTs); Gene disease association; DNA fingerprinting; Microarray based techniques for RNA analysis; metagenomics.	U

CL:CognitiveLevels(R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	3	2	3	2	3	2	3	3	3	3	3	3	2
CO2	3	3	3	3	2	3	2	3	2	3	3	3	3	3	3	2
CO3	3	3	3	3	2	2	2	3	2	3	3	3	2	3	2	1
CO4	3	3	3	3	2	2	2	3	2	3	3	3	2	3	2	1
CO5	3	3	3	3	2	2	2	3	2	3	3	3	2	3	3	2

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: BE1001 Proteomics and Genomics

Unit No.	Topics	No. of Lectures	CO No.
I	Introduction and scope of proteomics; Protein separation techniques: ionexchange, size-exclusion and affinitychromatography techniques; Polyacrylamide gel electrophoresis; Isoelectric focusing (IEF); Two dimensional PAGE for proteome analysis; Image analysis of 2D gels.	18	1
II	Introduction to mass spectrometry; Strategies for protein identification; Protein sequencing; Protein modifications and proteomics; Applications of proteome analysis to drug.	12	2
III	Protein-protein interaction (Two hybrid interaction screening); Protein engineering; Protein chips and functional proteomics; Clinical and biomedical application of proteomics; Proteome database; Proteomics industry.	16	3
IV	Introduction and Classification of genomics; Methods of preparing genomic DNA; Genome sequencing methods (next-generation sequencing);Databases of genomes; Genetic mapping; Mapping of human genome; Human genome project; Hap Map Project, The genome project, and The ENCODE Project.	14	4
V	Gene variation and Single Nucleotide Polymorphisms (SNPs); Expressed sequenced tags (ESTs); Gene disease association; DNA fingerprinting; Microarray based techniques for RNA analysis; metagenomics.	15	5

BOOKS SUGGESTED:

SN	Author	Book
1	John Wiley & Sons (1999)	Cantorand Smith, Genomics
2	Arthur M Lesk, Oxford University Press, 2007	Introduction to Genomics
3	R.M. Twyman 2004	Principles of Proteomics, BIOS Scientific Publishers
4	P. Michael Conn 2003	Handbook of Proteomic Method. Humana Press, Totowa, New Jersay, USA
5	L. Stryer 2007	Biochemistry, W. H. Freeman and Co., New York

Integrated M.Sc. Semester – X

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	5	X

Course Code	Course Title	Course Type
BE1002	**Nanobiotechnology**	**Elective**

Credit	Hours Per Week (L-T-P)		
	L	T	P
5	4	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):
Course helps to understand numerous applications of nanotechnology in a wide variety of disciplines. Targeted drug delivery, diagnosis of diseases, bioimaging, nanomedicines, nanoarrays, and gene therapy are all being investigated as nanobiotechnology applications in biomedical sciences.

Course Outcomes (CO):

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Concept of Nano- biotechnology, Historical background, Development. Fundamental sciences and broad areas of Nanobiotechnology.	U
2.	Nanomaterial in biotechnology - nanoparticles, quantum dots, nanotubes and nanowires etc. Nanostructures-Overview and introduction,	U
3.	Biosensors, Application of various transducing elements as part of nanobiosensors.	E
4.	Miniaturized devices in nanobiotechnology - types and applications, Biological nanoparticles production - plants and microbial, methods, Properties, Characterization and applications.	Ap
5.	Nanobiotechnological applications in health and disease	Ap

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	2	3	3	3	3	2	3	2	3	2	3	2	2
CO2	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
CO3	3	3	3	3	2	3	3	3	1	3	3	3	3	3	3	1
CO4	3	3	3	3	2	3	3	3	1	3	3	3	3	3	3	1
CO5	3	3	3	3	2	3	3	3	2	3	3	3	3	3	3	2

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: BE1002 Nanobiotechnology

Unit No.	Topics	No. of Lectures	CO No.
I	The nanoscale dimension and paradigm, various definitions and Concept of Nano- biotechnology, Historical background, Development. Fundamental sciences and broad areas of Nanobiotechnology.	12	1
II	Nanomaterial in biotechnology - nanoparticles, quantum dots, nanotubes and nanowires etc. Cell – Nanostructure interactions. Protein-based Nanostructures, Cell as Nanobio-machine, DNA-Protein Nanostructures-Overview and introduction, DNA- Protein conjugates in microarray technology.	18	2
III	Biosensors; molecular recognition elements, transducing elements. Applications of molecular recognition elements in nanosensing of different analytes, Application of various transducing elements as part of nanobiosensors.	16	3
IV	Miniaturized devices in nanobiotechnology - types and applications, lab on a chip concept. Biological nanoparticles production - plants and microbial, methods, Properties, Characterization and applications.	14	4
V	Nanobiotechnological applications in health and disease - infectious and chronic. Nanobiotechnological applications in Environment and food - detection and mitigation.	15	5

BOOKS SUGGESTED:

SN	Author	Book
1	Christof M, Niemeyer (Editor), Chad A. Mirkin (Editor), Wiley VCH 2004	Nanobiotechnology: Concepts, Applications and Perspectives
2	Chad A Mirkin and Christof M. Niemeyer (Eds), Wiley VCH.	Nanobiotechnology-II more concepts and applications.
3	P. Michael Conn 2003	Nanotechnology in Biology and Medicine: Methods, Devices, and Applications

Integrated M.Sc. Semester – X

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	5	X
Course Code	Course Title		Course Type
ZE-1001	**Animal Behaviour and Population Ecology**		**Elective**
Credit	Hours Per Week (L-T-P)		
	L	T	P
5	4	1	0
Maximum Marks	CIA		ESE
100	60		40

Learning Objective (LO):-

The learning objectives for a course on "Animal Behavior and Population Ecology" aim to provide students with a comprehensive understanding of the principles governing the behavior and interactions of animals within populations and ecosystems. Students will explore the mechanisms and adaptive significance of animal behaviors, including communication, mating, foraging, and social dynamics.

Course Outcomes(CO):-

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Unit I: Students will understand the history and branches of ethology, analyze behavior patterns, biological rhythms, and methods of studying behavior. They'll explore learning types, memory conditioning, and sensory mechanisms underlying behavior.	U
2	Learners will grasp various forms of learning, communication modes, reproductive behaviors, and ecological behaviors like altruism. They'll comprehend the influence of hormones and pheromones on animal behavior.	U
3	Students will analyze ecological aspects of behavior, including feeding strategies, social organization, language evolution, and aggregation behaviors. They'll understand bird migration, navigation, reproductive behaviors, and parental care in amphibians.	U
4	Learners will comprehend population characteristics, demography, and population growth models. They'll analyze reproductive strategies and understand population density dynamics.	Ap
5	Students will explore competition, mutualism, predation, and population regulation mechanisms. They'll analyze niche theory, mutualistic interactions, and distribution patterns of organisms in ecosystems.	Ap

CL:CognitiveLevels(R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	1	-	2	-	1	-	2	2	2	-	2	1	3	3
CO2	3	2	1	-	2	1	1	-	1	2	2	-	2	1	3	3
CO3	3	2	2	-	2	1	1	-	1	2	2	-	2	1	3	3
CO4	2	2	3	1	1	-	1	-	1	2	2	1	1	1	2	3
CO5	3	2	3	1	2	1	1	-	1	2	2	1	2	1	3	3

e

Detailed Syllabus: ZE1001 Animal Behaviour and Population Ecology

	Topics	No of lectures	CO
Unit-I	Ethology- history & branches, Ethogram- analysis of behaviour,Concept and Patterns of behavior, Biological rhythm, Fixed Action pattern, Reflex Action, Sign stimulus, Orientation, kinesis and taxis. Methods of studying behavior,, Learning & memory conditioning: Classical, Instrumental and Insight learning,	10	1
Unit II	Learning- Types of Learning, habituation, reasoning, neural mechanism of learningBiological Rhythms, communication-chemical, visual, light, tactile and audio, Reproductive Behaviour – Display, Courtship, Sexual Selection and Mating Systems. Ecological Behavior – Altruism and kin selection. Hormones and Pheromones Influencing Behavior of Animals	20	
Unit-III	Ecological aspects of behaviour-feeding strategies & territorial behaviour. Social behavior social organization in insects & primate, evolution of language (Primates and honey bee). Aggregation- schooling in fishes & flocking in birds, Bird migration, navigation and orientation, reproductive behavior, Parental care in amphibian.	10	3
Unit-IV	Population characterstics, Demography-life table. Population growth-exponential, logistic, stochastic & time lag. Population density, reproductive strategies (r and k selection).	10	4

Unit-V	Competition & niche theory, Mutualism (plants pollinator & animal interaction), predation, population regulation (extrinsic & intrinsic), distribution of organism.	10	5

Books Recommended:

SN	Author	Book
1	John Alcock	Introduction to Animal Behaviour (4th Edition
2	Frank N. Egerton and Gregory C. Mayer, published by Oxford Bibliographies.	Animal Population Ecology
3	Philip A. Abrams	The Behavioral Ecology of Fishes (2nd Edition)
4	Michael Begon, Martin Mortimer, and David J. Thompson (Blackwell Publishing)	Population Ecology

Integrated M.Sc. Semester – X

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	5	X
Course Code	Course Title		Course Type
ZE-1002	**Neurobiology**		**Elective**
Credit	Hours Per Week (L-T-P)		
	L	T	P
5	4	1	0
Maximum Marks	CIA		ESE
100	60		40

Course Outcomes(CO):-

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Chemical composition of the brain: cells,structure, function and metabolism	U
2	Neurotransmitters, mechanism of action of neurotransmission	U
3	Sleep and Learning and memory: Electroencephalogram. Role of second messenger pathways in learning and memory process. Role of synaptic plasticity.	U
4	Sensory organs: Vision: Audition:	Ap
5	Chemical senses: Olfaction and Taste, mechanism of function, Touch/pain: Pathologies of the nervous system:	L

CL: Cognitive Levels (R-Remember; U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	Pos											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	1	1	2	-	1	-	1	2	2	3	3	1	1	2
CO2	3	3	2	1	2	-	1	-	1	2	2	3	3	1	1	2
CO3	3	3	2	1	3	-	2	-	1	2	2	3	3	2	1	2
CO4	2	2	1	1	2	-	1	-	1	2	2	2	2	1	1	2
CO5	2	2	1	1	2	-	1	-	1	2	2	2	2	1	1	2

Detailed Syllabus: ZE-1002: Neurobiology

	Topics	No of lectures	CO
Unit-I	The glial system: Generation of Astrocytes, Oligodendrocytes, and Schwan cells. Function of glia in normal brain and in neuroprotection. Chemical composition of the brain: metabolism (utilization and uptake of glucose and amino acids). Blood□Brain barrier.	10	1
Unit II	Neurotransmitters: Synthesis, storage, release, uptake, degradation and action of neurotransmitters, Acetyl choline, GABA, Serotonin, Dopamine, Glutamate, Nitrous oxide, etc. Receptors: different subtypes (cholinergic, dopaminergic, adrenergic, and glutamatergic), mechanism of action, Agonists and Antagonists – their mode of action and effects. Exocytosis of neurotransmitter – Role of synapsins, synaptogamins, SNAP, SNARE and other proteins in docking, exocyotosis and recycling of vesicles.	20	2
Unit-III	Sleep and Learning and memory: Mechanism of short□term memory and Long□term memory (long-term potentiation). Role of sleep in memory consolidation. Electroencephalogram. Role of second messenger pathways in learning and memory process. Role of synaptic plasticity.	10	3
Unit-IV	Sensory organs: Vision: Biochemistry of vision: Rod and cone cells, mechanism and regulation of vision, color vision, visual field, visual acuity. Visual pathway and topographic mapping. Audition: functional anatomy of the middle and inner ear. Amplification of sound. Functional anatomy and mechanism of detection of specific sound frequency in the inner ear. Mechanism of action of the mechanosensory receptors in the inner ear.	10	4
Unit-V	Chemical senses: Olfaction: The olfactory pathway, mechanism and the combinatorial code of detecting a smell. Taste: Mechanism of taste perception. Touch/pain: The touch/pain/temperature pathway (ascending and descending). Higher order integration in the brain. Pathologies of the nervous system: Molecular basis of Parkinson's disease, Alzheimer's disease, Schizophrenia, Myasthenia gravis and Multiple sclerosis, stress and antidepressants.	10	5

Books Recommended:

S.No.	Author	Book
1.	Ferdinand Hucho	Neurochemistry
2.	MP Spiegel	Basic Neurochemistry
3.	Koenig and Edward	Cell Biology of the Axon, Series: Results & Problems in Cell Differentiation, Vol. 48
4.	Eric Kendel, JH Schwartz, T Jessel	Principles of neural Sciences
5.	A Guyton and J Hall	Textbook of medical Medical physiolog

Integrated M.Sc. Semester – X

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	5	X
Course Code	Course Title		Course Type
ZE-1003	**Animal Tissue Culture**		**ELECTIVE**
Credit	Hours Per Week (L-T-P)		
	L	T	P
5	4	1	0

Maximum Marks	CIA	ESE
100	60	40

Learning Outcome (LO): Animal cell culture has found use in diverse areas, from basic to advanced research. It has provided a model system for a variety of research efforts.

Course Outcomes (CO):-

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Introduction and significance of Animal cell culture, historical background of cell culture. Types of cell culture: Laboratory requirements for animal cell culture	U
2	Culture requirements and reagents	L
3	Types of cell culture: Different types of cell cultures, Celllines: Introduction, development ofcell lines	U
4	Stem cell research, Current status and application in medicine. Application of animal cell culture for in vitro testing of drugs;Application of cell culture technology in production of human and animal viral vaccines and pharmaceutical proteins.	Ap
5	Gene transfer technology in animals, Animal cloning: Techniques, relevance and ethical issues.	Ap

CL:CognitiveLevels(R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	-	1	1	-	1	-	2	3	3	3	3	-	2	3
CO2	3	2	1	1	1	-	1	-	2	3	3	3	2	1	2	3
CO3	3	2	1	1	1	-	1	-	2	3	3	3	2	1	2	3
CO4	3	2	3	1	2	1	2	2	2	3	3	3	3	2	2	3
CO5	3	2	2	1	1	1	1	3	2	3	3	2	-	-	2	3

Detailed Syllabus: ZE-1003: Animal Tissue Culture

	Topics	No of lectures	CO
Unit-I	Introduction and significance of Animal cell culture, historical background of cell culture. Types of cell culture: Primary and secondary cell culture. Laboratory requirements foranimalcell culture: Sterile handlingarea. Sterilizationof different materials used in animal cell culture, Aseptic concepts. Instrumentation and equipment for animal cell culture.	15	1
Unit II	Culture requirements and reagents: Culture media, properties of media, Types of cell culture media, Ingredients of media, Physiochemical properties, Antibiotics, growth supplements, Foetal bovine serum; Serum free media, Tryps in solution, Selection of medium and serum, Conditioned media, other cell culture reagents, Preparation and sterilization of cell culture media, different types of serum and other reagents	20	2
Unit-III	Types of cell culture: Different types of cell cultures, Trypsinization, Cell separation, Continuous cell lines, Suspension culture, Organ culture. Celllines: Introduction, development of celllines, Characterization and maintenance of celllines, stemcells, Cryopreservation, Common cell culture contaminants	15	3
Unit-IV	Stem cell research: Stem cell types, properties and biological significance, Current status and application in medicine. Application of animal cell culture for in vitro testing of drugs; Application of cell culture technology in production of human and animal viral vaccines and pharmaceutical proteins. Production of different recombinant proteins. General account of in vitro regulation of blood cells production.	10	4
Unit-V	Gene transfer technology in animals: Different method in gene transfer technology in animals, viral and non-viral methods, Production of transgenic animals, current status in the field of transgenic animals .Animal cloning: Techniques ,relevance and ethical issues.	10	5

Books recommended:

1. Freshney,CultureofAnimalCells,5thEdition,Wiley-Liss,2005
2. Ed. John R.W. Masters, Animal Cell Culture - Practical Approach, 3rd Edition, Oxford University Press,2000.
3. Ed.MartinClynes,AnimalCellCultureTechniques,Springer,1998.
4. B.Hafez,E.S.EHafez,ReproductioninFarmAnimals,7thEdition,Wiley-Blackwell, 2000.
5. Louis-MarieHoudebine,TransgenicAnimals:GenerationandUse,1st Edition,CRC Press,1

Integrated M.Sc. Semester – X

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	5	X
Course Code	Course Title		Course Type
ZE-1004	**Applied Zoology**		**ELECTIVE**
Credit	Hours Per Week (L-T-P)		
	L	T	P

5	4	1	0
Maximum Marks	CIA	ESE	
100	40	60	

Learning Outcome (LO): The scope applied Zoology is innumerable. It provides the knowledge of medicine, dentistry, Veterinary medicine, medical technology, nursing, Museum Work, Zoological teaching, zoological research, environmental science and conservation.

Course Outcomes (CO):-

CO No.	Expected Course Outcomes At the end of the course ,the students will be able to:	CL
1	Protozoans and Human Diseases: Students will comprehend the life cycles and pathogenicity of protozoan parasites such as Entamoeba histolytica, Plasmodium vivax, and Trypanosoma gambiense, understanding their roles in diseases like amoebiasis, malaria, and sleeping sickness. They will analyze transmission modes and develop strategies for prevention and control of these diseases.	U
2	Insects and Human Diseases: This unit will familiarize students with the medical significance of various insects, including mosquitoes, flies, fleas, lice, ticks, and mites, in transmitting diseases. They will learn about methods for controlling these vectors and evaluate the effectiveness of national disease control programs.	U
3	Beneficial Insects: Students will explore the importance of beneficial insects, particularly honeybees and silkworms, in apiculture and sericulture industries. They will understand modern beekeeping methods, sericulture techniques, and the significance of lac culture in India.	U
4	Aquaculture: This unit will provide students with knowledge of freshwater fish culture, focusing on major carps and breeding techniques. They will assess the economic importance of fish and pearl industries in India.	Ap
5	Microbiology and Agriculture: Students will gain insight into bacterial and viral diseases, including COVID-19, and their implications for public health. Additionally, they will explore various aspects of microbiology, including industrial, medical, and environmental applications, as well as sustainable agriculture practices and vermitechnology.	L, Ap

CL:CognitiveLevels(R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	Pos											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	1	-	1	-	-	-	1	3	2	3	2	-	-	3
CO2	3	2	2	-	1	1	-	-	1	3	2	3	3	-	-	3
CO3	3	1	1	-	1	-	-	-	1	3	2	3	2	-	1	3
CO4	3	2	2	-	1	-	-	-	1	3	2	3	2	-	1	3
CO5	3	2	1	1	2	-	1	-	1	3	2	3	2	-	2	3

Detailed Syllabus ZE-1004: Applied Zoology

	Topics	No of lectures	CO
Unit-I	Insects and human diseases: diagnosis of diseases, Medical importance and control of Mosquitoes species, Flies, Flea, Lice, Ticks and Mites ;National vector borne Disease Control programs.	10	1
Unit II	Beneficial insects: Apiculture: Different species and life cycle of honey bees. Behaviour and communication in bee colony, Bee keeping: Modern methods and industries in India Sericulture: Life cycle of silk worm. Types of silk moth and silk. Culture of silk worm, Silk industry in India. Lac culture: Lac insects, life cycle, culture and lac industry in India	20	2
Unit-III	Aquaculture: Culture of fresh water fishes (Major carps), Induced breeding, Economic importance of fishes. Fish industry in India. Pearl culture and pearl industries in India.	10	3
Unit-IV	General account of Bacteria and viruses in relation to diseases. COVID-19, Brief idea of Industrial, Medical and Environmental microbiology; Sustainable agriculture and vermitechnology	10	4
Unit-V	Livestock production: Commercial Dairy Farming , Poultry culture and cattle farming	10	5

Books Recommended:

1. Fishponds in Farming Systems, Zijpp, V. D., Verreth, J. A. J., Tri, L. Q., van Mensvoort, M. E. F., Bosma, R. H., and Beveridge, M. C. M., Wageningen Academic Publishers, Netherlands 40
2. Aquaculture Principles and Practices, Pillay, T. V. R., Blackwell Publishing, USA
3. Aquaculture and Fisheries Biotechnology Genetic Approaches, Dunham, R. A., CABI Publishing, USA

Integrated M.Sc. Semester – X

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	5	X
Course Code	Course Title		Course Type
ZE-1005	**Endocrinology**		**ELECTIVE**
Credit	Hours Per Week (L-T-P)		
	L	T	P
5	4	1	0

Maximum Marks	CIA	ESE
100	40	60

Learning outcome (LO): Identify the contributions of the endocrine system to homeostasis. Discuss the chemical composition of hormones and the mechanisms of hormone action. Summarize the site of production, regulation, and effects of the hormones of the pituitary, thyroid, parathyroid, adrenal, and pineal glands.

Course Outcomes (CO):-

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Structure and function of endocrine glands: the unit includes the basic structure and different parts of an endocrine gland along with their functions.	U
2	Biosynthesis and chemical nature of different hormones: this unit mainly includes different hormones released by endocrine glands, their biosynthesis and the chemical nature.	U
3	Hormonal regulation of Metabolism: this unit emphasizes on role of different hormones in regulation of body metabolism.	U
4	Hormones and reproduction: This unit includes role of different hormones in reproduction.	Ap
5	Genetic basis of hormonal disorders: this unit includes general principle and classification of hormonal disorders .	L, Ap

CL:CognitiveLevels(R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	1	-	1	-	-	-	1	3	2	3	2	-	-	3
CO2	3	2	2	-	1	1	-	-	1	3	2	3	3	-	-	3
CO3	3	1	1	-	1	-	-	-	1	3	2	3	2	-	1	3
CO4	3	2	2	-	1	-	-	-	1	3	2	3	2	-	1	3
CO5	3	2	1	1	2	-	1	-	1	3	2	3	2	-	2	3

Detailed syllabus ZE-1005: Endocrinology

	Topics	No of lectures	CO
Unit-I	Structure and function of endocrine glands (Thyroid, Pitutary, pineal, pancreas, adrenal glands etc.	10	1
Unit II	Biosynthesis and chemical nature of different hormones: Thyroid, Pitutary, pancreas, adrenal glands etc.	20	2
Unit-III	Hormonal regulation of Metabolism	10	3
Unit-IV	Hormones and reproduction: study of different reproductive hormones and their mechanism.	10	4
Unit-V	Genetic basis of hormonal disorders: General principle and classification of hormonal disorders Genetic basis of PCOS, thyroid disorders, diabetes, cancer of endocrine glands etc.	10	5

Books Recommended:

General endocrinology by Turner, C. Donnell (Clarence Donnell), Bagnara, Joseph T. (Joseph Thomas),
Endocrinology: An Integrated Approach by by S.S. Nussey (Author), S.A. Whitehead 2001
Endocrinology by Hadley 6th edition 2009

Integrated M.Sc. Semester – X

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	5	X
Course Code	**Course Title**		**Course Type**
BE1003	**EARTH SCIENCE AND ENERGY & ENVIRONMENTAL SCIENCES**		**ELECTIVE**
Credit	**Hours Per Week (L-T-P)**		
	L	**T**	**P**
5	4	1	0
Maximum Marks	**CIA**		**ESE**
100	40		60

Course Outcomes(CO):-

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1	Earth's Structure and Processes: Students will comprehend the origin of the Earth, its layered structure, and rock types with their properties. They will analyze mechanisms of rock formation, plate tectonics, and mantle plumes' role. They'll understand Earth's physical properties and instrumentation used in studying seismic and electromagnetic waves.	L
2	Earth's Magnetic Field and Seismology: This unit will enable students to explain Earth's internal magnetic field, polar wandering, and paleomagnetic studies. They'll understand seismology principles and its role in understanding Earth's layers, along with the utility of geophysical techniques.	U
3	Environmental Science and Global Climate Change: Students will gain insight into environmental science, covering ecosystems, biodiversity, and socio-cultural environments. They'll analyze global climate change effects, including the carbon cycle and its calculations.	L
4	Water Management, Hazards, and Energy Sources: This unit will familiarize students with water harvesting, storage, and treatment methods. They'll explore natural calamities, hazards, and human impacts, along with an introduction to energy sources, power production, consumption, and issues related to renewable and non-renewable energy sources.	Ap
5	Energy Sources and Management: By the end of this unit, students will have a comprehensive understanding of energy sources, including their evolution, production, consumption, and associated issues such as energy crises. They will also evaluate the prospects and challenges of renewable and non-renewable energy sources, considering both centralized and decentralized production methods.	L

CL:CognitiveLevels(R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	2	1	1	-	-	1	-	-	3	3	3	-	1	-	3
CO2	3	2	2	1	-	-	1	-	-	3	3	3	-	1	-	3
CO3	3	2	2	1	2	2	1	-	-	3	3	2	2	-	2	3
CO4	3	2	3	1	2	1	1	-	-	3	3	3	3	1	2	3
CO5	3	2	3	2	2	1	1	1	-	3	3	3	2	2	2	3

Detailed syllabus BE-1003: EARTH SCIENCE AND ENERGY & ENVIRONMENTAL SCIENCES

	Topics	No of lectures	CO
Unit-I	Origin of the earth, type of rocks in different layers, and their physical and chemical properties; Mechanism of their formation and destruction; Radioactivity and its role in geochronology; Plate tectonics and geodynamics and the role of mantle plumes in sustaining these processes; Gravity, electrical, seismic, and magnetic properties of the different layers in the earth, their variations in different geological terrains; Instrumentation and field procedures used in these studies; Response of the earth to the elastic (Seismic) and electromagnetic waves, use of this phenomenon to study the earth's interior.	20	1
Unit II	Geodynamo and the internal magnetic field of the earth; Paleomagnetic studies, Polar wandering and reversal, possible theoretical arguments for understanding the phenomena; Seismology and its use in understanding the different layers in the earth's interior; Utility of the different geophysical techniques (discussed above) in exploration for academic as well as for harnessing resources.	10	2
Unit-III	Introduction to Environmental Science. Natural Environments: Ecosystems and ecology, biodiversity. Socio□cultural environments: demography, population density, human organizations. Land use and its planning. Global climate change and effects on environment. Carbon cycle from human activity, calculation of carbon budgets.	10	3
Unit-IV	Water harvesting, storage, and treatment; Natural calamities, hazards, and effects of human activity: Chemical and other technological hazards; Introduction to energy sources □ evolution of energy sources with time; Power production, per capita consumption in the world, and relation to development index; Energy scenario in India: Various issues related to consumption and demands □ energy crisis issues in India; Renewable and non-renewable energy sources □ technology and commercialization of energy sources, local (decentralized) versus centralized energy production, constraints and opportunities of renewable energy (hydrocarbon and coal-based energy sources).	10	4
Unit-V	Energy conservation – calculation of energy requirements for typical and home and industrial applications; Alternative to fossil fuels □ solar, wind, tidal, geothermal; Bio-based fuels; Hydrogen as a fuel; Energy transport and storages, comparison of energy sources □ passage from source to delivery (source, production, transport, delivery) □ efficiencies, losses, and wastes; Nuclear energy: Power production: Components of a reactor and its working, types of reactors and comparison; India's three-stage nuclear program; Nuclear fuel cycle; Thorium-based reactors; Regulations on nuclear energy.	10	5

Books Recommended:

S.No.	Author	Book
1	Merill RT, McElhinny MW and McFadden PL	The magnetic field of the Earth: International Geophysical Series
2	EdwardJ,TarbuckEJandLutgensFK	Earth Science
3	HR Sheehan *et al.*,	Introduction to Applied Geophysics: Exploring the Shallow Subsurface Burger
4	Condie KC	MantlePlumesandTheirRecordinEarth History; Cambridge University Press, Cambridge, UK

Integrated M.Sc. Semester – VIII

Program	Subject	Year	Semester
Integrated M.Sc.	Zoology	4	VIII

Course Code	Course Title	Course Type
SEBL801	**Statistical Tools in Biological Research**	**Skill Enhancement Course**

Credit	Hours Per Week(L-T-P)		
	L	T	P
2	0	0	4

Maximum Marks	CIA	ESE
100	60	40

Learning Objective (LO):
To understand various statistical tools used in biological research.

Course Outcomes (CO):-

CO No.	Expected Course Outcomes At the end of the course, the students will be able to:	CL
1.	Basic knowledge of SPSS software tool, Preparation and presentation of data	A
2.	Provide knowledge of calculating Descriptive statistics	E
3.	Provide knowledge of Parametric and Non-parametric test	E
4.	Provide knowledge of ANOVA, Comparison of means, preparation of different charts	E
5.	Provide basic knowledge of NTSYS Pc software, Jaccard coefficient, Principle component Analysis, Dendrogram construction	E

CL: Cognitive Levels (R-Remember;U-Understanding;Ap-Apply;An-Analyze;E-Evaluate;C-Create).

CO-PO/PSO Mapping for the course:

PO/CO	POs											PSO				
	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5
CO1	3	3	3	2	2	1	2	1	-	2	2	3	1	2	-	3
CO2	3	3	3	2	2	1	2	1	-	2	2	3	1	2	-	3
CO3	3	3	3	2	2	1	2	1	-	2	2	3	1	2	-	2
CO4	3	3	3	2	2	1	2	1	-	2	2	3	1	2	-	2
CO5	3	3	3	1	2	1	2	1	-	2	2	3	1	2	-	2

"3"–Strong;"2"–Moderate;"1"-Low;"-"No Correlation

Detailed Syllabus: SEBL801 Statistical Tools in Biological Research

Unit No.	Topics	No. of Lectures	CO No.
I	Introduction to SPSS software tool, Basic data preparation, Creating variables, entering data, Data management using SPSS	5	1
II	Experimental design strategy, Descriptive statistics using SPSS tool: Frequency distribution, Data types/Binomial Distribution, Poisson Distribution, Normal Distribution, Measures of central tendency, Measures of variability / Dispersion, Measures of deviation from the Normality	5	2
III	Parametric: One-sample t-test 2.4.2 Independent Sample t-test 2.4.3 Paired Sample t-test and Non-parametric tests, ANOVA, Comparison of means, Investigating relationship between variables-Correlation and Regression, Pearson Correlation, Spearman Rank Correlation, Partial Correlation	7	3
IV	Making Graphs and Charts using SPSS: Line Graphs, Bar Charts, Pie Charts, Histograms, Scatter Plots, Box Plots, Error Bars, High-Low Bars, Population Pyramids	7	4
V	Introduction to NTSYS Pc software, Creating data file, Jaccard coefficient, Principle component Analysis, Dendrogram construction	6	5

09.07.2024.

9/7/24