FATIMA COLLEGE (AUTONOMOUS)

Re-Accredited with "A++" Grade by NAAC (Cycle IV)
Maryland, Madurai- 625 018, Tamil Nadu, India

NAME OF THE DEPARTMENT: ZOOLOGY

NAME OF THE PROGRAMME : M. Sc

PROGRAMME CODE : PSZO

ACADEMIC YEAR :2023 - 2024

I-PG (TANSCHE)

FATIMA COLLEGE (Autonomous), MADURAI-625 018

MINUTES OF THE BOARD OF STUDIES

NAME OF THE DEPARTMENT: M.Sc ZOOLOGY

TO BE IMPLEMENTED FROM: 2023-2024 ONWARDS

VENUE: Department of Zoology

CONVENED ON: 05.04.2023 CONVENED AT: 02.00pm

MEMBERS PRESENT:

1.	Dr. A. Tamil Selvi	Head of the Department 05/04/23
2.	Dr. V. Shanmugaiah Assistant Professor Department of Microbial Technology School of Biological Scienees Madurai Kamaraj University Madurai-625 021	University Nominee 5/4/23
3.	Dr. P.J. Joslin Associate Professor PG & Research Department of Zoology St. Mary's college (Autonomous) Thoothukudi-628 001	Subject Expert P. J. Joslin 5/4/23
4.	Dr. R. Uma Maheswari Assistant Professor PG Department of Zoology Arulmigu Palaniandavar Arts college for Women Palani-624 615	Subject Expert 5/4/23

5. Dr. A. Vanniarajan Scientist Aravind Medical Research Foundation Madurai - 625 020	Industrialist / Scientist A. Vanniarajan 05/04/23
6. Miss. S. Susaritha Research Scholar PG & Research Department of Zoology The American College Madurai - 625 020	Alumna S. Susaritha 05/04/23
7. Dr. A. Rajeswari	Dean of Academic Affairs 05/04/2023
8. Dr. Antony Amala Jayaseeli	Staff Member Antony Amala Jayaseeli 05/04/23
9. Dr. N. Malathi	Staff Member N. Malathi 5/4/2023
10. Dr. J. Asnet Mary	Staff Member J. Asnet Mary 5/4/2023
11 Dr. V. Bharathy	Staff Member V. Bharathy 5/4/23
12 Dr. N. Nagarani	Staff Member N. Nag 5/4/23
13 Dr. S. Barathy	Staff Member S. Barathy 5/4/23
14 Mrs. J. Thelma	Staff Member J. Thelma 5/4/23
15 Mrs. D. Kayathri	Staff Member D. Kayathri 5/4/23

MINUTES OF THE BOARD OF STUDIES:

CORE COURSES INTRODUCED (PART-A)

S. NO	COURSE CODE	COURSE TITLE WITH SEMESTER	RELEVANCE TO				SCOPE FOR			NEED FOR INTRODUCTION
			L	R	N	G				
1.	CC1	Invertebrata Semester - I	L	R	N	G	–	–	SD	
2.	CC2	Cell & molecular Biology Semester-I	–	–	N	G	–	–	SD	As per the guidelines of TANSCHE
3.	CC3	Lab in Invertebrata, Cell & Molecular Biology	L	R	N	G	EMP	–	SD	
4.	CC4	Chordata Semester-II	L	R	N	G	–	–	SD	
5.	CC5	Genetics Semester-II	–	–	N	G	–	–	SD	
6.	CC6	Lab in Chordata & Genetics	L	R	N	G	EMP	–	SD	

ELECTIVE COURSES INTRODUCTION (PART-A)

S. NO	Generic/ Discipl Specific	COURSE CODE	COURSE TITLE	RELEVANCE TO				SCOPE FOR			NEED FOR INTRODUCTION
				L	R	N	G	EMP	ENT	SD	
1.	Discipline Specific Sem-I	EC1	Fisheries & Aquaculture/	L	R	N	G	EMP	ENT	SD	
			Environmenta Toxicology	L	R	N	G	–	–	SD	As per the guidelines of TANSCHE
2.	Disciplı Specific Sem II	EC2	Microbiology / Biophysics	–	–	N	G	–	–	SD	
				–	–	N	G	–	–	SD	
3.	Generic Sem II	EC3	Solid waste Management	L	R	N	G	EMP	ENT	SD	

4.	Discipline Specific Semester - II	EC 4	Biochemistry / Ethology	-	-	N	G	-	-	SD
				-	-	N	G	-	-	SD

SKILL ENHANCEMENT / ABILITY ENHANCEMENT COURSES (PART-B)

S. NO	SEC/AECC SEMESTER	COURSE CODE	COURSE TITLE	Relevance To				Scope For			NEED FOR INTRODUCTION
				L	R	N	G	EMP	ENT	SD	
1.	SEC Semester I	SEC 1	Bioethics & IPR	-	-	N	G	EMP	-	SD	As per the guidelines of TANSCHE
2.	SEC Semester II	SEC 2	Biostatistics & Research Methodology	-	-	N	G	EMP	-	SD	

Details of Proposed/Signed MOUS - NIL

SUGGESTIONS	COMMENDATIONS
1. The List of Reference books may also be updated with recent editions. 2. comma and hyphen should be used appropriately while preparing the course content.	1. Introduction of the Skill Enhancement course - Bioethics & IPR is a new attempt to make the young minds to show interest towards patent or new findings. 2. Introduction of the course - Solid Waste Management is need of the hour.

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2.	Dr. V. Shanmugaiah	University Nominee 5/4/23
3.	Dr. P.J. Joslin	Subject Expert P. J. Josl 5/4/2023
4.	Dr. R. Uma maheswari	Subject Expert R. Uma Maheswari 5/4/23
5.	Dr. A. Vanniarajan	Industrialist/Scientist A. Vanniarajan 05/04/23
6.	Miss. S. Susaritha	Alumna S. Susaritha 05/04/23
7.	Dr. A. Rajeswari	Dean of Academic Affairs 05/04/2023
8.	Dr. Antony Amala Jayaseeli	Antony Amala Jayaseeli 05/04/23
9.	Dr. N. Malathi	N. Malathi 5/4/2023
10.	Dr. J. Asnet Mary	5/4/2023
11.	Dr. V. Bharathy	V. Bharathy 5/4/23
12.	Dr. N. Nagarani	5/4/23
13.	Dr. S. Barathy	5/4/23
14.	Mrs. J. Thelma	5/4/23
15.	Mrs. D. Kayathri	D. Kayathri 5/4/23

VISION OF THE DEPARTMENT

Women Empowerment through Biological Education for the Betterment of Environment and Mankind

MISSION OF THE DEPARTMENT

- To ensure quality education offering skill-based program
- To render entrepreneurial training to make students employable
- To create awareness on the conservation of Biodiversity
- To give ultimate insight into the correlation of various branches of biology that has overwhelming applications
- To facilitate Higher education & research (for the advanced learners)

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 1	Our graduates will be academic, digital and information literates; creative, inquisitive, innovative and committed researchers who would be desirous for the "more" in all aspects
PEO 2	They will be efficient individual and team performers who would deliver excellent professional service exhibiting progress, flexibility, transparency, accountability and in taking up initiatives in their professional work
PEO 3	The graduates will be effective managers of all sorts of real – life and professional circumstances, making ethical decisions, pursuing excellence within the time framework and demonstrating apt leadership skills

PEO 4	They will engage locally and globally evincing social and environmental stewardship demonstrating civic responsibilities and employing right skills at the right moment.

GRADUATE ATTRIBUTES (GA)

Fatima College empowers her women graduates holistically. A Fatimite achieves all-round empowerment by acquiring Social, Professional and Ethical competencies. A graduate would sustain and nurture the following attributes:

I. SOCIAL COMPETENCE	
GA 1	Deep disciplinary expertise with a wide range of academic and digital literacy
GA 2	Hone creativity, passion for innovation and aspire excellence
GA 3	Enthusiasm towards emancipation and empowerment of humanity
GA 4	Potentials of being independent
GA 5	Intellectual competence and inquisitiveness with problem solving abilities befitting the field of research
GA 6	Effectiveness in different forms of communications to be employed in personal and professional environments through varied platforms
GA 7	Communicative competence with civic, professional and cyber dignity and decorum
GA 8	Integrity respecting the diversity and pluralism in societies, cultures and religions
GA 9	All – inclusive skill - sets to interpret, analyse and solve social and environmental issues in diverse environments

GA 10	Self-awareness that would enable them to recognise their uniqueness through continuous self-assessment in order to face and make changes building their strengths and improving on their weaknesses
GA 11	Finesse to co-operate exhibiting team-spirit while working in groups to achieve goals
GA 12	Dexterity in self-management to control their selves in attaining the kind of life that they dream for
GA 13	Resilience to rise up instantly from their intimidating setbacks
GA 14	Virtuosity to use their personal and intellectual autonomy in being life-long learners
GA 15	Digital learning and research attributes
GA 16	Cyber security competence reflecting compassion, care and concern towards the marginalised
GA 17	Rectitude to use digital technology reflecting civic and social responsibilities in local, national and global scenario
II. PROFESSIONAL COMPETENCE	
GA 18	Optimism, flexibility and diligence that would make them professionally competent
GA 19	Prowess to be successful entrepreneurs and employees of trans-national societies
GA 20	Excellence in Local and Global Job Markets
GA 21	Effectiveness in Time Management
GA 22	Efficiency in taking up Initiatives
GA 23	Eagerness to deliver excellent service
GA 24	Managerial Skills to Identify, Commend and tap Potentials

III. ETHICAL COMPETENCE	
GA 25	Integrity and discipline in bringing stability leading a systematic life promoting good human behaviour to build better society
GA 26	Honesty in words and deeds
GA 27	Transparency revealing one's own character as well as self-esteem to lead a genuine and authentic life
GA 28	Social and Environmental Stewardship
GA 29	Readiness to make ethical decisions consistently from the galore of conflicting choices paying heed to their conscience
GA 30	Right life skills at the right moment

PROGRAMME OUTCOMES (PO)

On completion of M.Sc. ZOOLOGY Programme, the graduates would be able to

PO 1	Apply acquired scientific knowledge to solve major and complex issues in the society/industry.
PO 2	Attain research skills to solve complex cultural, societal and environmental issues.
PO 3	Employ latest and updated tools and technologies to solve complex issues.
PO 4	Demonstrate Professional Ethics that foster Community, Nation and Environment Building Initiatives.

PROGRAMME SPECIFIC OUTCOMES (PSO)

On completion of M.Sc. ZOOLOGY programme, the graduates would be able to

PSO 1	Gain comprehensive knowledge in different branches of zoology – Cell & Molecular Biology, Biochemistry, Microbiology, Developmental Biology, Immunology, Genetics, Biotechnology, Bioinformatics and Evolution.
PSO 2	Interrelate the concepts of gene, genome, cell, tissue, organ and organ-system in the physiological adaptations, development, reproduction, behaviour of microbes, plants and animals
PSO 3	Perform experiments in the field of Microbiology, Biochemistry, Cell & Molecular Biology, Environmental Biology, Developmental Biology, Biostatistics, Immunology, Genetics, Biotechnology and Bioinformatics.
PSO 4	Develop empathy towards conservation of plants and animals and appreciate the diversity of animals and their inclusiveness in the sustenance of an ecosystem.
PSO 5	Express ideas and concept through oral presentation and organize research data in the form of dissertation writing.
PSO 6	Solve the environmental, social and ethical problems by applying the biological principles for minimizing pollutants by waste water treatment and solid waste management for eco-sustainable development.
PSO 7	Address the local, regional, national and global environmental issues and mitigating the same through Intervention strategies adopting standard protocol.
PSO 8	Practice judicious way of using animals in experiments, proper disposal of hazardous biological waste and ethics related to conserving endangered animals and plants.
PSO 9	Exhibit the holistic growth by developing interpersonal skills, subject proficiency, and to seek employability in clinical laboratory, Research institutions, Medical coding and IT companies.

PSO 10	Make them self employed/ Entrepreneur in the field of Sericulture, Fisheries and Aquaculture, Dairy farming, Apiculture and Poultry.
PSO 11	Use of computers for Power point presentation, Virtual Dissection, analysis of bio- molecules using bioinformatics software and computing biological data.
PSO 12	Healthy diet pattern for combat life style disorder.

MAJOR CORE – 70 CREDITS

PROGRAMME CODE:

S. No	SEM.	COURSECODE	COURSE TITLE	HRS	CREDITS	CIA Mks	ESE Mks	TOT. MKs
1.	I	23PG1Z1	Structure and Function of Invertebrates	7	5	40	60	100
2.		23PG1Z2	Comparative Anatomy of Vertebrates	7	5	40	60	100
3.		23PG1Z3	Lab Course in Invertebrates &Vertebrates	6	5	40	60	100
4.	II	23PG2Z4	Cellular and Molecular Biology	6	5	40	60	100
5.		235G2Z5	Developmental Biology	6	5	40	60	100
6.		23PG2Z6	Lab Course in Cell Biology & Developmental Biology	6	4	40	60	100
7.	III	19PG3Z11	Biophysics	6	5	40	60	100
8.		19PG3Z12	Immunology	6	5	40	60	100
9.		19PG3Z13	Biostatistics &Research Methodology	6	5	40	60	100
10.		19PG3Z14	Lab in Biophysics &Biostatistics	4	2	40	60	100
11.		19PG3Z15	Lab in Immunology, Fisheries &Aquaculture and Bioinformatics	4	2	40	60	100
12.	IV	19PG4Z16	Environmental Biology	6	5	40	60	100
13.		19PG4Z17	Biotechnology	6	5	40	60	100
14.		19PG4Z18	Developmental Biology	6	5	40	60	100
15.		19PG4Z19	Lab in Environmental Biology &Developmental Biology	4	2	40	60	100
16.		19PG4Z20	Lab in Biotechnology, Economic Zoology & Ethology	4	2	40	60	100
			TOTAL	**104**	**70**			

MAJOR ELECTIVE / EXTRA DEPARTMENTAL COURSE / INTERNSHIP/ PROJECT -20 CREDITS

S. No	SEM.	COURSECODE	COURSE TITLE	HRS	CREDITS	CIA Mks	ESE Mks	TOT. Mks
1.	I	23PG1ZE1/ 23PG1ZE2	Molecules and their interaction relavant to Biology / Fisheries &Aquaculture	5	3	40	60	100
2.		23PG1ZE3/ 23PG1ZE4	Biostatistics/ Environmental Toxicology	5	3	40	60	100
3.		23PG1ZAE	Sericulture	2	2	40	60	100
4.	II	23PG2ZE5 /23PG2ZE6	Economic Entomology / Microbiology	4	3	40	60	100
5.		23PG2ZE7 /23PG2ZE8	Research Methodology / Biophysics	4	3	40	60	100
6.		23PG2ZEA	Poultry Farming	4	2	40	60	100
7.	III	19PG3ZE1/ 19PG3ZE2	Fisheries & Aquaculture / Bioinformatics	4	4	40	60	100
8.		19PG3ZSI	Summer Internship	-	3	40	60	100
9.	IV	19PG4ZE3/ 19PG4ZE4	EconomicZoology/ Ethology	4	4	40	60	100
10.		19PG4ZPR	Project*&Viva Voce	-	3	50	50	100
			TOTAL	**14**	**20**			

OFF-CLASS PROGRAMMES

ADD-ON COURSES

COURSE CODE	COURSES	HRS.	CREDITS	SEMESTER IN WHICH THE COURSE IS OFFERED	CIA MKS	ESE MKS	TOTAL MARKS
19PAD2SS	**SOFT SKILLS**	40	3	I	40	60	100
19PAD2CA	• COMPUTER APPLICATIONSComputerApplication forBiologists /SPSS	40	4	II	40	60	100
19PAD4CV	**COMPREHENSIVE VIVA**(Question bank to be prepared for all the courses by the respective course teachers)	-	2	IV	-	-	100
19PAD4RC	**READING CULTURE**	2	1	I- II	-	-	-
	TOTAL		**10**				

EXTRA CREDIT COURSES

Course Code	Courses	Hrs.	Credits	Semester in which the course is offered	CIA Mks	ESE Mks	Total Marks
21PG2ZSL	**SELF LEARNING COURSES for ADVANCED LEARNERS** Fermentation Technology	-	2	II	40	60	100
21PG4ZSL	Vector Borne Disease	-	2	IV	40	60	100

- **Lab Courses:**
  - A range of 10-15 experiments per semester

- **Summer Internship:**
  - Duration-1 month (2nd Week of May to 2nd week of June-before college reopens)
- **Project:**
  - Off class
  - Evaluation components-Report writing + Viva Voce (Internal marks-40) + External marks 60

- **EDC:**Syllabus should be offered for two different batches of students from other than the parent department inSem-I &Sem-II

I M.Sc. Zoology

SEMESTER – I

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	23PG1Z1	Structure and Function of Invertebrates	Theory	6	5

COURSE DESCRIPTION

This course provides an overview of the Invertebrate and Vertebrate animals byfocussing on the General characters, Classification, Special features and Biology ofsome selected Invertebrates.

COURSE OBJECTIVES

- To understand the concept of classification and their characteristic features of major group of invertebrates.
- To realize the range of diversification of invertebrate animals.
- To enable to find out the ancestors or derivatives of any taxon.
- To know the functional morphology of system biology of invertebrates.

UNITS

UNIT I **(21 Hrs)**

Structure and function in invertebrates: Principles of Animal taxonomy; Species concept; International code of zoological nomenclature; Taxonomic procedures; New trends in taxonomy.

UNIT II **(21 Hrs)**

Organization ofcoelom: Acoelomates; Pseudocoelomates; Coelomates: Protostomia andDeuterostomia; Locomotion: Flagella and ciliary movement

inProtozoa; Hydrostatic movement in Coelenterata, Annelida andEchinodermata.

UNIT III **(21 Hrs)**

Nutrition and Digestion: Patterns of feeding and digestion in lower metazoan; Filter feeding in Polychaeta, Mollusca and Echinodermata. Respiration: Organs of respiration: Gills, lungs and trachea; Respiratory pigments; Mechanism of respiration.

UNIT IV **(21 Hrs)**

Excretion:
Organsofexcretion:coelom,coelomoducts,NephridiaandMalphigiantubules; Mechanisms ofexcretion; Excretion andosmoregulation. Nervoussystem: Primitive nervous system: Coelenterata andEchinodermata;Advanced nervous system: Annelida, Arthropoda (Crustacea and lnsecta) and Mollusca (Cephalopoda); Trends in neuralevolution.

UNIT V **(21 Hrs)**

Invertebrate larvae: Larval forms of free living invertebrates - Larval forms of parasites; Strategies and Evolutionary significance of larval forms. Minor Phyla: Concept and significance; Organization and general characters.

REFERENCES:

1. Kotpal R.L. (2020). Modern Text Book of Zoology Invertebrates (12 thed), Rastogi Publications, Meerut, 2020
2. Kashyap.V (2019). A Text Book of Invertebrate Zoology. KedarNath Ram Nath Publications, Meerut, 2019.
3. Jordan E.L., and Verma P.S. (2012). *Invertebrate Zoology*, S.Chand& Co, New Delhi, 2012.
4. Prasad S.N.(1989). *Invertebrate Zoology*, Vikas publishing House Pvt Ltd, India, 1989.
5. Newman. H.H (1987). *The Phylum Chordata*, Satish Book Enterprise, Motikala.
6. EkambaranathaAyyar M. and Ananthakrishnan T.N. (1981). A manual of Zoology, Part-II (Chordate), Viswanathan (Printers and Publishers) Pvt. Ltd, Chennai

7. Young J.Z. (1962). *The Life of Vertebrates*. Oxford University Press, New York, ed. 2, 1962

8. Barnes, R. D. 1974. Invertebrate Zoology, (Second Edition), Holt-Saunders International Edition, pp-1024.

9. Barnes, R. S. K., P. Calow, P. J. W. Olive, D. W. Golding, J. J. Spicer. 2013. The Invertebrates: A Synthesis. Third Edition. John Wiles & Sons Inc., Hoboken. New Jersey, New Delhi.

3. Dechenik, J. A. 2015. Biology of Invertebrates (Seventh Edition).Published by McGraw Hill Education (India) Private Limited, pp-624.

Web Resources

DIGITAL OPEN EDUCATIONAL RESOURCES

1. https://www.oercommons.org/courseware/lesson/15073/overview
2. https://opened.cuny.edu/courseware/lesson/753/overview
3. https://www.nationalgeographic.com/animals/invertebrates/
4. https://bit.ly/3kABzKa
5. https://www.nio.org/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT ISTRUCTURE AND FUNCTION IN INVERTEBRATES				
1.1	Structure and function in invertebrates: Principles of Animal taxonomy;	6	Chalk & Talk	Black Board
1.2	Species concept;	5	Chalk & Talk	Black Board
1.3	International code of zoological nomenclature;	5	Chalk & Talk	PPT

1.4	Taxonomic procedures;	5	Chalk & Talk	LCD
UNIT -2 ORGANIZATION OF COELOM				
2.1	Organization ofcoelom: Acoelomates; Pseudocoelomates; Coelomates:	6	Chalk & Talk	Black Board
2.2	Protostomia andDeuterostomia;	5	Chalk & Talk	Black Board
2.3	Locomotion: Flagella and ciliary movement inProtozoa;	5	Chalk & Talk	PPT
2.4	Hydrostatic movement in Coelenterata, Annelida andEchinodermata.	5	Chalk & Talk	LCD
UNIT -3 NUTRITION AND DIGESTION				
3.1	Nutrition and Digestion: Patterns of feeding and digestion in lower metazoan;	5	Chalk & Talk	Black Board
3.2	Filter feeding in Polychaeta, Mollusca and Echinodermata.	5	Chalk & Talk	Black Board
3.3	Respiration: Organs of respiration: Gills, lungs and trachea; Respiratory pigments;	6	Chalk & Talk	PPT
3.4	Mechanism of respiration.	5	Chalk & Talk	LCD
UNIT -4 EXCRETION				
4.1	Excretion: Organsofexcretion:coelom,coe	4	Chalk & Talk	Black Board

	lomoducts,NephridiaandMalphigiantubules;			
4.2	Mechanisms ofexcretion;	4	Chalk & Talk	Black Board
4.3	Excretion andosmoregulation.	3	Chalk & Talk	PPT
4.4	Nervoussystem: Primitive nervous system: Coelenterata andEchinodermata;	4	Chalk & Talk	LCD
4.5	Advanced nervous system: Annelida, Arthropoda (Crustacea and lnsecta) and Mollusca (Cephalopoda);	3	Lecture	PPT
4.6	Trends in neuralevolution.	3	Chalk & Talk	Black Board
UNIT -5 INVERTEBRATE LARVAE				
5.1	Invertebrate larvae: Larval forms of free living invertebrates	5	Chalk & Talk	Black Board
5.2	Larval forms of parasites;	5	Chalk & Talk	PPT
5.3	Strategies and Evolutionary significance of larval forms.	5	Chalk & Talk	LCD
5.4	Minor Phyla: Concept and significance; Organization and general characters.	6	Lecture	PPT

Components	**Marks**	**Converted Marks**
T1	**30**	**15**
T2	**30**	

Assignment		**3**
Seminar		**5**
Attendance		**2**
	Total	**25 Marks**

EVALUATION PATTERN

MARKS		
CIA	**ESE**	**Tota l**
25	**75**	**100**

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.	**K1 & K2**	PSO1, PSO2
CO 2	Understand the evolutionary process. All are linked in a sequence of life patterns.	**K2 & K4**	PSO1, PSO2
CO 3	Apply this for pre-professional work in agriculture and conservation of life forms.	**K3 & K5**	PSO1, PSO3, PSO7
CO 4	Analyze what lies beyond our present knowledge of life process.	**K4 & K6**	PSO1, PSO3

CO 5	Evaluate and to create the perfect phylogenetic relationship in classification.	**K5 & K6**	PSO1, PSO4

Mapping COs Consistency with PSOs

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	S	M	M	M	S	M	M	M
CO2	M	S	M	M	M	M	M	M
CO3	S	M	M	S	M	M	M	M
CO4	S	M	M	S	S	M	M	M
CO5	S	M	S	M	M	M	M	M

S-Strong(3) M-Medium (2) L-Low (1) B N

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	M	M
CO3	S	M	S	M
CO4	S	M	S	M
CO5	S	M	S	M

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

Forwarded By

HOD'S Signature & Name

I M.Sc. Zoology

SEMESTER – I

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	23PG1Z2	Comparative Anatomy of Vertebrates	Theory	6	5

COURSE DESCRIPTION

This course familiarizes the invertebrate phyla, and their anatomy. It also provides special attention to lower invertebrates of economic and medical importance to the human environment.

COURSE OBJECTIVES

- To understand the structures and distinct features of invertebrate phyla.
- To understand and able to distinguish the characteristic features of each phylum
- To understand the economic importance of invertebrates
- To understand the interaction of invertebrates with the environment.
- To understand the evolutionary position of different groups of invertebrates

UNITS

Unit I

Origin of vertebrates: Concept ofProtochordata; The nature of vertebratemorphology; Definition,scopeandrelationtootherdisciplines; Importance of the study of vertebratemorphology.

Unit II

Origin and classification of vertebrates; Vertebrate integument and itsderivatives.Development,generalstructureandfunctionsofskinanditsderivatives; Glands, scales, horns, claws, nails, hoofs, feathers andhairs.

Unit III

General plan of circulation in variousgroups; Blood; Evolution ofheart; Evolution of aortic arches and portalsystems. Respiratorysystem: Characters of respiratorytissue; Internal and external respiration; Comparative account of respiratoryorgans

Unit IV

Skeletal system: Form, function, body size and skeletal elements of the body; Comparative account of jawsuspensorium, Vertebral column; Limbs and girdles; Evolution of Urinogenital system in vertebrate series.

Unit V

Senseorgans: Simplereceptors; Organs of Olfaction andtaste; Lateral linesystem; Electroreception. Nervous system: Comparative anatomy of the brain in relation to itsfunctions; Comparative anatomy of spinalcord; Nerves-Cranial, Peripheral and Autonomous nervoussystems.

REFERENCES:

Text Books

1. SwayamPrabha https://www.swayamprabha.gov.in/index.php/program/archive/9
2. Yong, J. Z. 1981. The life of Vertebrates, English language Book society, London, pp-645.
3. Romer, A.S. 1971. The Vertebrate body, W.B.S. Saunders, Philadelphia, pp-600.

References Books

Waterman, A.J. 1972. Chordate Structure and Function, MacMillan Co., New York, pp.587.

Parker T. J. and W. A. Haswell. 1962. A text book of Zoology, Vol. 2, Vertebrates, 7th Edition, Mac Millan Press, London, pp-750.

EkambaranathaAyyar and T. N. Ananthakrishnan. 2009. Manual of Zoology, Vol – II, S. ViswanathanPvt. Ltd. Chennai.

Kotpal, 2019.R.L. Modern Text Book of Zoology Vertebrates, 4th Edition, Rastogi Publications, Meerut, pp-968.

DIGITAL OPEN EDUCATIONAL RESOURCES

1. https://www.nationalgeographic.com/animals/invertebrates/
2. https://bit.ly/3kABzKa
3. https://www.nio.org/
4. https://bit.ly/3lJdUX0

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 ORIGIN OF VERTEBRATES				
1.1	Origin of vertebrates	2	Chalk and Talk	Black Board
1.2	Concept ofProtochordata	3	Chalk and Talk	Black Board
1.3	The nature of vertebratemorphology	3	Chalk and Talk	Black Board
1.4	Importance of the study of vertebratemorphology	2	Chalk and Talk	Black Board
1.5	Definition,scopeandrelationto otherdisciplines	2	Chalk and Talk	Black Board
UNIT -2 ORIGIN AND CLASSIFICATION OF VERTEBRATES				
2.1	Origin and classification ofvertebrates;.	3	Chalk and Talk	Black Board

2.2	Vertebrate integument and itsderivatives	3	Chalk and Talk	Black Board
2.3	Development,generalstructureandfunctionsofskinanditsderivatives; Glands, scales, horns, claws, nails, hoofs, feathers andhairs.	6	Chalk and Talk	Black Board
UNIT -3 CIRCULATION AND RESPIRATION				
3.1	General plan of circulation in variousgroups;	1	Chalk and Talk	Black Board
3.2	Blood; Evolution ofheart;	3	Chalk and Talk	Black Board
3.3	Evolution of aortic arches and portalsystems.	3	Lecture	PPT & White Board
3.4	Respiratorysystem: Characters of respiratorytissue; Internal and external respiration;	2	Chalk and Talk	Black Board
3.5	Comparative account of respiratoryorgans	3	Chalk and Talk	Black Board
UNIT IV: **SKELETAL SYSTEM**				
4.1	Skeletalsystem: Form, function, body size and skeletal elements of thebody;	4	Chalk and Talk	Black Board
4.2	Comparative account of jawsuspensorium,	2	Lecture	PPT & White Board
4.3	Vertebral column; Limbs andgirdles	3	Chalk and Talk	Black Board

4.4	Evolution of Urinogenital system in vertebrateseries	3	Chalk and Talk	Black Board
UNIT V: SENSE ORGANS				
5.1	Senseorgans: Simplereceptors; Organs of Olfaction andtaste;.	3	Chalk and Talk	Black Board
5.2	Lateral linesystem; Electroreception.	3	Chalk and Talk	Black Board
5.3	Nervous system: Comparative anatomy of the brain in relation to itsfunctions;	2	Lecture	PPT & White Board
5.4	Comparative anatomy of spinalcord; Nerves-Cranial,	3	Chalk and Talk	Black Board
5.5	Peripheral and Autonomous nervoussystems	1	Chalk and Talk	Black Board

Components	**Marks**	**Converted Marks**
T1	**30**	**15**
T2	**30**	
Assignment		**3**
Seminar		**5**
Attendance		**2**
	Total	**25 Marks**

EVALUATION PATTERN

MARKS

CIA	ESE	Tota l
25	75	100

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.	K1 & K2	PO1
CO 2	Understand the evolutionary process. All are linked in a sequence of life patterns.	K2 & K4	PO1, PO2
CO 3	Apply this for pre-professional work in agriculture and conservation of life forms.	K3 & K5	PO3, PO4, PO5
CO 4	Analyze what lies beyond our present knowledge of life process.	K4 & K6	PO4, PO5, PO6
CO 5	Evaluate and to create the perfect phylogenetic relationship in classification.	K5 & K6	PO1, PO2, PO3, PO8

Mapping of COs with PSOs

COs	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0
CO1	S	M	L	S	M	S	M	S	M	S
CO2	S	L	L	S	M	S	M	M	M	M
CO3	S	M	L	S	M	S	M	L	M	M
CO4	S	L	L	S	L	S	M	L	M	L
CO5	S	M	L	S	S	S	M	S	M	M

*S - Strong; M - Medium; L - Low

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	S	M	M	M
CO2	S	M	M	M
CO3	S	M	M	M
CO4	S	M	M	M
CO5	S	M	M	M

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

COURSE DESIGNER:

Forwarded By

HOD'S Signature
& Name

I M.Sc.,ZOOLOGY

SEMESTER –I

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	**23PG1Z3**	**Lab Course in Invertebrates & Vertebrates**	**Practical**	**6**	**4**

COURSE DESCRIPTION

This course will give a thorough investigation of Invertebrates and Chordates, looking at the anatomy and contrasting the characteristics.

COURSE OBJECTIVE

- Understand the fundamental organization of animals.
- Reorganization of the anatomy of the body plan in invertebrates and vertebrates, at the level of organs and systems.
- Identification of their morphological and anatomical structures.

INVERTEBRATES

Dissection (Demo/ Virtual dissection)

Earthworm : Nervous system
Pila : Digestive and nervous systems
Sepia : Nervous system
Cockroach : Nervous system
Grasshopper : Digestive system and mouth parts
Prawn : Appendages, nervous and digestive systems
Crab : Nervous system

Study of the following slides with special reference to their salient features and their modes of life

1. *Amoeba*
2. *Entamoebahistolytica*
3. *Paramecium*
4. *Hydra* with bud
5. Sporocyst – Liver fluke
6. *Cercaria*larva

7. *Tape worm (Scolex)*
8. *Ascaris*T. S.
9. Mysis of prawn

Spotters

1. Scorpion
2. *Penaeusindicus*
3. *Emerita* (*Hippa*)
4. *Pernaviridis*

Mounting

Earthworm : Body setae
Cockroach : Mouth parts
Grasshopper: Mouth parts

CHORDATES

Study the nervous system of Indian dog shark – Dissection (Demo/ Virtual dissection)

1. Nervous system of *Scoliodonlaticaudatus* – 5th or Trigeminal nerve
2. Nervous system of *Scoliodonlaticaudatus* – 7th or Facial nerve
3. Nervous system of *Scoliodonlaticaudatus* – 9th and 10th or Glossopharyngeal &Vagus nerve

Study of the following specimens with special reference to their salient features and their modes of life

1. *Amphioxus* sp. (Lancelet)
2. *Ascidia* sp. (sea squirt)
3. *Scoliodonlaticaudatus*(Indian dog shark)
4. *Trygon*sp. (Sting ray)
5. *Torpedo* sp. (Electric ray)
6. *Arius maculatus*(Cat fish)
7. *Belone cancila*(Flute fish)
8. *Exocoetuspoecilopterus*(Flying fish)
9. *Mugilcephalus*(Mullet)
10. *Tilapia mossambicus*(Tilapia)
11. *Rachycentroncanadum*(Cobia)
12. *Tetrodon punctatus* (Puffer fish)
13. *Dendrophis*sp. (Tree snake)

Study of the different types of scales in fishes

1. Cycloid scale
2. Ctenoid scale
3. Placoid scale

Study of the frog skeleton system (Representative samples)

1. Entire skeleton

2. Skull
3. Hyoid apparatus
4. Pectoral girdle and sternum
5. Pelvic girdle
6. Fore limb
7. Hind limb

Mounting

1. Weberian ossicles of fish

Text Books:

1. Lal, S.S. 2009. Practical Zoology, Rastogi Publications, pp-484.
2. Iuliis G. D. and D. Pulerà, 2007. The Dissection of Vertebrates: A Laboratory Manual. Academic Press, Imprint of Elsevier Publication, pp-416.
3. Verma, P.S. 2000. Manual of Practical Zoology: Chordates, S. Chand Publishing Company, pp-528

Reference Books:

1. Preeti, G., and C. Mridula, 2000. Modern Experimental Zoology, Indus International Publication.

Sinha, J., A. K. Chatterjeee, P. Chattopadhya. 2011. Advanced Practical Zoology, Arunabha Sen Publishers, pp-1070.

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):.

1. https://oercommons.org/search?f.search=vertebrates
2. https://oercommons.org/courseware/lesson/15077/overview
3. https://oercommons.org/courseware/lesson/15083/overview?section=9
4. https://animaldiversity.org/
5. https://www.oercommons.org/courses/creaturecast-anurida

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
Invertebrates				
1.	Earthworm : Nervous system	4	Demonstration and Hands on training	Earthworm

2.	*Pila* : Digestive and nervous systems	4	Demonstration and Hands on training	Pila
3.	*Sepia* : Nervous system	4	Demonstration and Hands on training	Sepia
4.	Cockroach : Nervous system	4	Demonstration	Cockroach
5.	Grasshopper : Digestive system and mouth parts	4	and Hands on training	Grasshopper
6	Prawn : Appendages, nervous and digestive systems	4	Demonstration	Prawn
7	Crab : Nervous system	4	and Hands on training	Crab
8	SLIDES Amoeba Entamoebahistolytica Paramecium Hydra with bud Sporocyst – Liver fluke Cercaria larva Tape worm (Scolex) Ascaris T. S. Mysis of prawn	4		
9	**SPOTTERS** Scorpion *Penaeusindicus* *Emerita* (*Hippa*) *Pernaviridis*	4	Explanation	Spotters
7.	**Mounting** Prochordata – Amphioxus (entire); Chordata – Anguilla (Eel), Toad (Bufo), Hyla, Ichthyophis, Cobra, Viper, Enhydrina, Chamaeleon, Draco,	4	Explanation	Spotters

	Chelone, Echidna, Manis			
8	Earthworm : Body setae	4	Explanation	
9	*Pila* : Radula	4	Demonstration and Hands on training	
10	Cockroach : Mouth parts	4	Demonstration and Hands on training	Nutrient Agar and Broth
11	Grasshopper : Mouth parts	4	Demonstration and Hands on training	Soil, Water and Food
Chordates				
CHORDATES				
	Study the nervous system of Indian dog shark - Dissection 1. Nervous system of *Scoliodonlaticaudatus* – 5th or Trigeminal nerve 2. Nervous system of *Scoliodonlaticaudatus* – 7th or Facial nerve 3. Nervous system of *Scoliodonlaticaudatus* – 9th and 10th or Glossopharyngeal &Vagus nerve	4	Virtual dissection	
	Study of the following specimens with special reference to their	4	Virtual dissection	Bacteria

	salient features and their modes of life 1. *Amphioxus* sp. (Lancelet) 2. *Ascidia* sp. (sea squirt) 3. *Scoliodonlati caudatus*(Indian dog shark) 4. *Trygon*sp. (Sting ray) 5. *Torpedo* sp. (Electric ray) 6. *Arius maculatus*(Cat fish) 7. *Belone cancila*(Flute fish) 8. *Exocoetuspo ecilopterus*(Flying fish) 9. *Mugilcephal us*(Mullet) 10. *Tilapia mossambicus*(Tila pia) 11. *Rachycentro ncanadum*(Cobia) 12. *Tetrodon punctatus* (Puffer fish) 13. *Dendrophis*s p. (Tree snake)			
	Study of the different types of scales in fishes 1. Cycloid scale 2. Ctenoid scale 3. Placoid scale	4	Demonstrati on and Hands on training	Fish scales
	Study of the frog skeleton system (Representative samples) 1. Entire skeleton 2. Skull	4	Virtual dissection	

	3. Hyoid apparatus 4. Pectoral girdle and sternum 5. Pelvic girdle 6. Fore limb 7. Hind limb			
	Mounting 1. Weberian ossicles of fish	4	Demonstration and Hands on training	Fish

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Understand the structure and functions of various systems in animals	**K2 & K4**	PSO1& PSO2
CO 2	Learn the adaptive features of different groups of animals	**K1 & K2**	PSO2
CO 3	Learn the mounting techniques	**K2 & K3**	PSO5
CO 4	Acquire strong knowledge on the animal skeletal system	**K2 & K4**	PSO8 & PSO9
CO 5	Learn the salient features and their modes of life	**K2 & K4**	

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**
CO1	S	S	S	M	S	S	M	S	M	S
CO2	S	M	L	S	M	S	M	M	M	M
CO3	M	M	L	S	L	S	M	L	M	M
CO4	S	S	L	S	L	S	M	L	M	L
CO5	S	S	M	L	M	S	M	S	M	M

*S - Strong; M - Medium; L - Low

COURSE DESIGNER:

Forwarded By

HOD'S Signature & Name

I M.Sc. Zoology

SEMESTER – I

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	23PG1ZE1	Molecules and their interaction relevant to Biology	Lecture	5	3

COURSE DESCRIPTION

The course is designed to provide firm foundation in the principles of Biochemistry by providing knowledge on structure, biochemical properties of biomolecules and the role of these biomolecules in the major metabolic pathways of a living system.

COURSE OBJECTIVES

- Learn the structure, properties, metabolism and bioenergetics of Biomolecules
- Acquire knowledge on various classes and major types of enzymes, classification, their mechanism of action and regulation
- Understand the fundamentals of biophysical chemistry and biochemistry, importance and applications of methods in conforming the structure of biopolymers
- Familiarize the use of methods for the identification, characterization and conformation of biopolymer structures
- Comprehend the structural organization of and proteins, carbohydrates, nucleic acids and lipids

UNITS

Unit I

Basics of biophysical chemistry and biochemistry: Structure of atoms, molecules and chemical bonds - Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).

Unit II

Biomolecular interactions and their properties:Stabilizing interactions (Vander Waals, electrostatic, hydrogen bonding, hydrophobic interaction etc. - Composition, structure, metabolism and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).

Unit III

Bioenergetics and enzymology:Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers - Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isoenzymes

Unit IV

Structural conformation of proteins and nucleic acids:Conformation of proteins (Ramachandran plot, secondary, tertiary and quaternary structure; domains; motifs and folds) - Conformation of nucleic acids (A-, B-, Z-DNA),
t-RNA, micro-RNA).

Unit V

Stabilizing interactions in biomolecules:Stability of protein and nucleic acid structures - hydrogen bonding, covalent bonding, hydrophobic interactions and disulfide linkage.

Self Study -Parathyroid Gland, Pancreas, Adrenal Gland

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

REFERENCES:

1. Satyanarayana U., and ChakrapaniU.(2014)*Biochemistry, 4th Revised ed,* Reprinted. Elsevier, Reed Elsevier India Private Limited, New Delhi and Books and Allied (P) Ltd., Kolkata.

2. Rastogi S.C. (2006) *Biochemistry, 2nded, 5th Reprint.* Tata McGraw-Hill Publishing Company Limited, New Delhi).
3. Lehninger L.A., Nelson D.L and Cox M.M.(2005)*Principles of Biochemistry, 5th ed.*, W.H.Freeman and Company, New York.
4. Conn E.E., Stumpf P.K., Bruening G and Doi R.H. (2004). *Outlines of Biochemistry, 5th ed.*, John-Wiley and Sons, Singapore.
5. StryerL.(2003)*Biochemistry, 5th ed.*, W.H.Freeman Publishers, New York.
6. Murray K.R., Granner D.K., Mayer A.P and RodwellV.W.(2000)*Harper's Biochemistry, 25th ed.*, Appleton and Lange.
7. Devlin M.T.(1997) *Textbook of Biochemistry with Clinical Correlations,* Wiley-Liss Pub, New York.
8. Montgomery R., Conway T.W., Spector A.A and Chapell D. (1996) *Biochemistry – A case oriented approach, 6th ed.,* Mosby Inc., London.

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

1. http://www.oercommons.org/courses/biochemistry-3/view
2. https://openlab.citytech.cuny.edu/bio-oer/chemistry/biologically-important-macromolecules/proteins/
3. https://www.open.edu/openlearn/science-maths-technology/science/biology/proteins/content-section-1.1
4. https://ocw.mit.edu/high-school/biology/exam-prep/chemistry-of-life/enzymes/
5. http://www.iubmb-nicholson.org/chart.html

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1				

1.1	Structure of atoms,	2	Chalk & Talk	Black Board
1.2	Structure of molecules	2	Lecture	PPT
1.3	Structure of chemical bonds	3	Chalk & Talk	Green Board
1.4	Principles of biophysical chemistry (pH, buffer,	2	Lecture	PPT
1.5	reaction kinetics	3	Chalk & Talk	Black Board
1.6	Thermodynamics	3	Lecture	Black Board
1.8	colligative properties	3	Lecture	LCD
UNIT -2				
2.1	Biomolecular interactions and their properties:Stabilizing interactions (Vander Waals, electrostatic,	1	Lecture	Green Board
2.2	hydrogen bonding, hydrophobic interaction etc. -	2	Chalk & Talk	Green Board
2.3	Composition, structure, metabolism and function of biomolecules (carbohydrates,	3	Lecture	Smart Board
2.4	lipids,	3	Lecture	Board
2.5	proteins,	3	Lecture	LCD
2.6	nucleic acids	2	Chalk & Talk	Black Board
2.7	Vitamins	1	Chalk & Talk	Black Board
UNIT -3				
3.1	Bioenergetics and enzymology:Bioenergetics,	3	Chalk & Talk	Black Board

3.2	glycolysis, oxidative phosphorylation, coupled reaction,	3	Lecture	LCD
3.3	group transfer, biological energy transducers -	3	Lecture	LCD
3.4	Principles of catalysis, enzymes and enzyme kinetics,	3	Lecture	LCD
3.5	enzyme regulation, mechanism of enzyme catalysis, isoenzymes	3	Lecture	LCD
4.1	Structural conformation of proteins and nucleic acids:Conformation of proteins Ramachandran plot	2	Chalk & Talk	Black Board
4.2	-Conformation of nucleic acids (A-, B-, Z-DNA),	4	Lecture	LCD
4.3	Conformation of nucleic acids (A-, B-, Z-DNA),	4	Lecture	LCD
4.4	t-RNA, micro-RNA).	3	Lecture	PPT
5.1	Stabilizing interactions in biomolecules:Stability of protein	2	Chalk & Talk	Black Board
5.2	Stability of nucleic acid structures	1	Lecture	Green Board
5.3	hydrogen bonding,	2	Lecture	PPT
5.4	covalent bonding,	3	Lecture	LCD
5.5	hydrophobic interactions and disulfide linkage.	1	Discussion	Google classroom

Components	Marks	Converted Marks
T1	30	15
T2	30	
Assignment		3
Quiz / Seminar		5
Attendance		2
	Total	25 Marks

EVALUATION PATTERN

MARKS		
CIA	ESE	Tota l
25	75	100

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Analyse the Structure of atoms, molecules and chemical bonds	K4	PSO1,PSO2,PSO4,PSO 8

CO 2	Recall the structure, properties and metabolism of biomolecules.	**K1**	PSO1,PSO2,PSO4,PSO 8
CO 3	Assess the mechanism of enzyme action.	**K5**	PSO1,PSO2,PSO4,PSO 8
CO 4	Identify the thestructural conformation of proteins and nucleic acids	**K3**	PSO1,PSO2,PSO4,PSO 8
CO 5	Describe the stabilization of interactions in biomolecules	**K2**	PSO1,PSO2,PSO4,PSO 8

Mapping COs Consistency with PSOs

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO1	M	S	M	S	L	S	M	S	M	M
CO2	S	S	L	S	S	S	M	M	M	S
CO3	M	M	M	S	M	S	S	S	S	L
CO4	S	M	S	M	S	M	S	S	S	M
CO5	M	S	S	M	M	S	M	L	S	M

S-Strong(3) M-Medium (2) L-Low (1) B N

Mapping of COs with POs

CO/ PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10
CO1	3	3	3	3	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	3	3

CO3	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**
CO4	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**
CO5	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

COURSE DESIGNER:

Forwarded By

HOD'S Signature
& Name

Elective Course - Discipline Specific

I M.Sc., ZOOLOGY

SEMESTER –I

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	23PG1ZE2	Fisheries & Aquaculture	Lecture	5	3

COURSE DESCRIPTION

This Course focuses on Fisheries and Aquaculture of Finfishes, Marine Prawn, Pearl Oyster and Disease Management.

COURSE OBJECTIVES

To impart knowledge on Fisheries and Aquaculture Practices in India.

UNIT I - INDIAN CAPTURE FISHERIES (15 HRS)

History of Fisheries, Indian Capture Fisheries: Riverine fisheries, Estuarine fisheries, Reservoir fisheries, Lacustrine Fisheries, Cold-water fisheries; Marine Capture fisheries.

UNIT II - AQUACULTURE PRACTICES (15HRS)

Preparation and Construction of Ponds; Water Quality Management;Maintenance of Fish Farms; Fish Nutrition – Live feed, Artificial feed - FCR; Induced Breeding – Eyestalk ablation and Hypophysation.

UNIT III - CULTURE SYSTEMS (15 HRS)

Culture Systems – Based on habitat, expenses, site, climatic conditions and Composition of Organisms Culture of Indian Major Carps, Marine Prawn, Pearl Oyster and Sea Cucumber - Sewage fed fish culture, Integrated Fish Farming.

UNIT IV - FISH PATHOLOGY AND POST HARVEST TECHNOLOGY (15 HRS)

Parasitic diseases – Protozoan, Helminth, Crustacean, Fungal, Bacterial and Viral diseases and Deficiency Diseases; Preservation of Fish – Processing of Prawn; Fish Marketing – Domestic Market – Marine, Brackish &Inland Marketing & Export Market.

UNIT V - INDIAN FISHERIES &AQUACULTURE ECONOMICS (15 HRS)

Indian Fishing Gears and Methods, Fishing Crafts; Role of Government and Public Sector on Indian Fisheries, FFDAs.Economics of Fisheries and Aquaculture.

REFERENCE BOOKS:

1. Pandey K. and Shukla J.P., (2012) *Fish and Fisheries*, 3rd Revised ed., Rastogi Publications, Meerut.

2. Srivastava C.B.L., (2008) *A Textbook of Fishery Science and Indian Fisheries*, 3rd Revised ed., Published by KitabMahal, Allahabad.

3. Kumar R., (2012) *Fish Farming Management*, 1st ed., Arise Publishers and Distributors, New Delhi.

4. Chandrasekhar Y.S., (2013) *Fish Nutrition in Aquaculture*, 1st ed., Swastik Publications, New Delhi.

5. Reddy S.M. and Sambasiva Rao K.R.S., (1999) *A Textbook of Aquaculture*, Discovery Publishing House, New Delhi.

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

1. https://www.fao.org/3/l9805e/l9805e00.htm#
2. http://ecoursesonline.iasri.res.in/course/index.php?categoryid=72
3. https://nfdb.gov.in/
4. https://indianfisheries.icsf.net/
5. https://www.india.gov.in/topics/agriculture/fisheries
6. http://eprints.cmfri.org.in/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT-1 INDIAN CAPTURE FISHERIES				
1.1	History of Fisheries	2	Chalk & Talk	Black Board
1.2	Indian Capture Fisheries: Riverine fisheries, Estuarine fisheries, Reservoir fisheries, Lacustrine Fisheries, Cold-water fisheries	8	Chalk & Talk	LCD
1.3	Marine Capture fisheries: Inshore capture fisheries, Off shore and deep sea fisheries	5	Lecture	PPT & White board
UNIT-2 AQUACULTURE PRACTICES				
2.1	Preparation and Construction of Ponds	5	Lecture	Charts
2.2	Water Quality Management	3	Chalk & Talk	PPT& Videos
2.3	Maintenance of Fish Farms	2	Chalk & Talk	PPT
2.4	Fish Nutrition – Live feed, Artificial feed – FCR	3	Chalk & Talk	PPT& Videos
2.5	Induced Breeding – Eyestalk ablation and Hypophysation	2	Chalk & Talk	PPT
UNIT-3 CULTURE SYSTEMS				
3.1	Culture Systems – Based on habitat, expenses, site, climatic conditions and Composition of Organisms	2	Lecture	PPT& Videos

3.2	Culture of Indian Major Carps, Marine Prawn, Pearl Oyster and Sea Cucumber	8	Lecture	PPT& Videos
3.3	Sewage fed fish culture	2	Chalk & Talk	PPT& Videos
3.4	Integrated Fish Farming.	3	Chalk & Talk	PPT& Videos
UNIT-4 FISH PATHOLOGY AND POST HARVEST TECHNOLOGY				
4.1	Parasitic diseases – Protozoan, Helminth, Crustacean, Fungal, Bacterial and Viral diseases and Deficiency Diseases	10	Chalk & Talk	PPT& Videos
4.2	Preservation of Fish	2	Chalk & Talk	PPT& Videos
4.3	Processing of Prawn	1	Lecture	PPT& Videos
4.4	Fish Marketing	2	Lecture	PPT& Videos
UNIT-5 INDIAN FISHERIES				
5.1	Fishing Gears and Methods, Fishing Crafts	6	Chalk & Talk	PPT& Videos
5.2	Role of Government and Public Sector on Indian Fisheries, FFDAs.	5	Chalk & Talk	PPT& Videos
5.3	Economics of Fisheries and Aquaculture.	4	Chalk & Talk	PPT& Videos

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Identify the economically important fishes and fishery products.	**K1**	PSO1& PSO2
CO 2	Plans according to the recent concepts in fisheries management.	**K3**	PSO3
CO 3	Distinguish the various aquaculture systems.	**K2**	PSO5
CO 4	Organizes the type of hatchery, brood stock, larval production, feed management water quality and disease management in cultivable species, live feed production.	**K3**	PSO4, PSO9
CO 5	Evaluates the Fisheries and Aquaculture Practices in India.	**K4**	PSO5, PSO7 & PSO10

Mapping of COs with PSOs

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	P
CO 1	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	
CO 2	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	
CO 3	**2**	**2**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	

CO 4	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**3**	**2**	**3**
CO 5	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**-**	**3**	**2**

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	**3**	**2**	**2**	**2**
CO2	**2**	**2**	**2**	**2**
CO3	**2**	**2**	**2**	**3**
CO4	**2**	**2**	**3**	**2**
CO5	**2**	**3**	**2**	**2**

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

COURSE DESIGNER:

Dr. Antony AmalaJayaseeli

Forwarded By

HOD'S Signature & Name

I M.Sc. Zoology

SEMESTER – I

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
UAZO	23PG1ZE3	BIOSTATISTICS	Theory	5	3

COURSE DESCRIPTION

This course deals with specific procedures or techniques used to identify and process the research data.

COURSE OBJECTIVES

- Clear understanding of design and application of biostatistics relevant to experimental and population studies.
- Organise the research data in appropriate order and apply the measures of central tendency and dispersion values.
- Acquired skills to perform various statistical analyses using modern statistical techniques and software.
- Compute degrees of relationship variables using Correlation and Regression analysis
- Knowledge on the merits and limitation of practical problems in biological/ health management study as well as to propose and implement appropriate statistical design/ methods of analysis.

UNITS

UNIT –I INTRODUCTION TO BIOSTATISTICS (15 HRS.)

Definition, scope and application of statistics; Primary and secondary data: Source and implications; Classification and tabulation of biological data: Types and applications. Variables: Definition and types. Frequency

distribution: Construction of frequency, distribution table for grouped data; Graphic methods: Frequency polygon and ogive curve; Diagrammatic representation: Histogram, bar diagram, pictogram and pie chart.

UNIT – II MEASURES OF CENTRAL TENDENCY (15 HRS)

Measures of central tendency: Mean, median and mode for continuous and discontinuous variables. Measures of dispersion: Range, variation, standard deviation, standard error and coefficient of variation.

UNIT – IIIPROBABILITY (15 HRS)

Probability: Theories and rules; Probability - Addition and multiplication theorem; Probability distribution: Properties and application of Normal, Binomial and Poisson distributions.

UNIT – IV TESTING OF HYPOTHESIS (15 HRS)

Hypothesis testing: Student't' test - paired sample and mean difference't' tests. Correlation: Types - Karl Pearsons Co-efficient, Rank correlation, Significance test for correlation coefficients. Regression analysis: Computation of biological data, calculation of regression co-efficient, graphical representation and prediction.

UNIT – V TEST OF VARIANCE (15 HRS)

Analysis of variance: one way and two way classification. Data analysis with comprehensive statistical software using Statistical Package for the Social Sciences (SPSS).

REFERENCES:

1. Khan and Khanum., (2018) *Fundamentals& Biostatistics*, 5thed., Ukaaz Publications, Hyderabad.
2. Palanichami S., Manoharan M (2008) Statistical Methods for Biologists (Biostatistics), Palani Paramount Publications, Palani.
3. Kothari. C.R., (2009). *Research Methodology*, New Age International,
4. Ramakrishnan P., (2010). Biostatistics, Saras publication, Nagercoil, Tamil Nadu.
5. Gurumani N., (2010). *An Introduction to Biostatistics*, MJP Publishers, Chennai.

6. Satguru Prasad., (2012). *Elements of Biostatistics,*Rastogi publications, Meerut.
7. Bailey, N. T. J. 1959. Statistical in Biology, English Universities Press, London, pp-48.
8. Sokal, R. R. and F. J. Rohlf, 1973. Introduction to Biostatistics, W.H. Freeman, London, pp-467.
9. Sokal, R.R. and F.J. Rohlf. 1981. Biometry: The principles and practice of statistics in biological research, San Francisco: W.H. Freeman, London, pp-859.
10. Zar, J.H. 1998. Biostatistical Analysis, Pearson Education (Singapore) Pvt. Ltd., Delhi, India, pp-660.
11. Bailey, N. T. J. 1994. Statistical Methods in Biology (Third Edition), Cambridge University Press, Cambridge, pp-255.
12. Wayne W. Daniel. Biostatistics: A Foundation for Analysis in the Health Sciences, John Wiley & Sons Inc, USA, pp-443.
13. Snedecor, G. W. and W. G. Cochran. 1967. Statistical Methods (Sixth Edition), Oxford & IBH Publishing Co., New Delhi, pp-593.
14. Pagano, M. and K. Gauvreau. 2008. Principles of Biostatistics (Second Edition), Cengage Learning, New Delhi, pp-525.

Web Resources

DIGITAL OPEN EDUCATIONAL RESOURCES

1. http://www.oercommons.org/courses/biostatistics-methods-2/view
2. https://www.oercommons.org/courses/chi-square-test-08-54
3. https://www.oercommons.org/courses/anova-calculations
4. https://www.oercommons.org/authoring/21429-wp-12-1-additional-test-of-two-population-variance/view
5. https://vivaopen.oercommons.org/courseware/unit/420

COURSE CONTENTS & LECTURE SCHEDULE:

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids

UNIT - 1 COLLECTION & PROCESSING OF DATA				
1.1	Definition, scope and application of statistics	2	Chalk & Talk	Black Board
1.2	Primary and secondary data: Source and implications;	2	Chalk & Talk	Black Board
1.3	Classification and tabulation of biological data:Types and applications.	2	Lecture	PPT & White board
1.4	Variables: Definition and types.	2	Lecture	Black Board
1.5	Frequency distribution: Construction of frequency, distribution table for grouped data;	2	Lecture	Black Board
1.6	Graphic methods: Frequency polygon and ogive curve;	2	Lecture	Black Board
1.7	Diagrammatic representation: Histogram, bar diagram, pictogram and pie chart.	3	Lecture	Black Board
UNIT - 2 MEASURES OF CENTRAL TENDENCY AND DISPERSION				
2.1	Measures of central tendency: Mean and median for continuous and discontinuous variables.	3	Lecture	Black Board
2.2	Measures of central tendency: mode for continuous and discontinuous variables.	3	Chalk & Talk	Black Board
2.3	Measures of dispersion: Range, variation,	3	Chalk & Talk	Black Board
2.4	Standard deviation	3	Lecture	Black Board

2.5	Standard error and coefficient of variation.	3	Chalk & Talk	Black Board
UNIT – 3 PROBABILITY				
3.1	Probability: Theories and rules	3	Chalk & Talk	Black Board
3.2	Probability - Addition and multiplicationtheorem	2	Chalk & Talk	Black Board
3.3	Probability distribution: Properties of Normal, Binomial and Poisson distributions.	5	Chalk & Talk	Black Board
3.4	Probability distribution: Application of Normal, Binomial and Poisson distributions.	4	Lecture	Black board
UNIT - 4TESTING OF HYPOTHESIS				
4.1	Hypothesis testing: Student‘t’ test - paired sample and mean difference‘t’ tests.	4	Lecture	Black Board
4.2	Correlation: Types - Karl Pearsons Co-efficient, Rank correlation	4	Chalk &Talk	Black Board
4.3	Significance test for correlation coefficients.	3	Chalk & Talk	Black Board
4.4	Regression analysis: Computation of biological data, calculation of regression co-efficient, graphical representation and prediction.	4	Chalk & Talk	Black Board
UNIT - 5 TEST OF VARIANCE				

5.1	Analysis of variance: one way and two way classification.	5	Lecture	Black Board
5.2	Analysis of variance: two-way classification.	5	Chalk &Talk	Black Board
5.3	Data analysis with comprehensive statistical software using Statistical Package for the Social Sciences (SPSS).	5	Chalk & Talk	Black Board

Components	**Marks**	**Converted Marks**
T1	**30**	**15**
T2	**30**	
Assignment		**3**
Quiz / Seminar		**5**
Attendance		**2**
	Total	**25 Marks**

EVALUATION PATTERN

MARKS		
CIA	**ESE**	**Tota l**
25	**75**	**100**

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Clear understanding of design and application of biostatistics relevant to experimental and population studies.	**K2 & K3**	PO1
CO 2	Organise the research data in appropriate order and apply the measures of central tendency and dispersion values.	**K3**	PO1, PO2
CO 3	Acquired skills to perform various statistical analyses using modern statistical techniques and software.	**K3 & K4**	PO4, PO6
CO 4	Compute degrees of relationship variables using Correlation and Regression analysis	**K3**	PO3, PO8
CO 5	Knowledge on the merits and limitation of practical problems in biological/ health management study as well as to propose and implement appropriate statistical design/ methods of analysis.	**K5 & K6**	PO4, PO5, PO6

Mapping COs Consistency with PSOs

	Mapping with Programme Outcomes*									
	COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO 7**	**PO 8**	**PO9**	**PO10**
	CO1	S	M	L	M	S	S	M	S	M	M
	CO2	S	S	S	S	S	S	S	S	S	S
	CO3	M	S	S	S	S	S	S	S	S	L
	CO4	M	M	S	L	M	M	M	S	L	M
	CO5	M	M	S	L	M	S	M	L	S	M

*S-Strong; M-Medium; L- Low

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	2	3	2	2
CO2	2	3	2	2
CO3	2	3	2	2
CO4	2	3	2	2
CO5	2	3	2	2

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

Elective Course - Discipline Specific

I M.SC ZOOLOGY

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	23PG1ZE4	Environmental Toxicology	Lecture	5	3

COURSE DESCRIPTION

The goal of this course is to introduce the student to the field of Environmental Toxicology where the basic principles of toxicology are applied to environmental problems.

COURSE OBJECTIVES

- Apply the knowledge to evaluate the exposure and solving problems associated with environmental contaminants.
- Use the skills, techniques and tools necessary for a successful career in the field of environmental toxicology.
- Conduct assessments of the environment, analyze data and evaluate health impacts from exposure to contamination.
- Understand contemporary environmental issues and the impact of environmental toxicology in a global and societal context.

UNITS

UNIT – I BASICS OF TOXICOLOGY (15 HRS)

Definition, History, Scope and Importance of Ecotoxicology; Classification of Environmental toxicants – food, atmosphere and hydrosphere; Dose-Response Relationship- concept, assumption, measurement and curves - the factors influencing Dose- Response relationship.

Self-Study: History and Scope of Ecotoxicology

UNIT – II TRANSPORT AND FATE OF TOXICANTS IN THE ENVIRONMENT (15 HRS)

Transport and Fate of Toxicants in the Environment – Source of toxicants to the Environment; transport Process – Advection and diffusion. Equilibrium Partitioning – Air and Water partitioning. Transformation Processes – reversible and irreversible reactions. Environmental Persistence – abiotic degradation, Biotic degradation and non -degradative elimination process.

Self-Study: Transport of Toxicants

UNIT III - TRANSLOCATION OF TOXICANTS (15 HRS)

Introduction Absorption, Distribution, Metabolism (Phase I and II) and Excretion/Elimination of Xenobiotics (ADME) – barriers of translocation. Ecological magnification – Factors that influence Bioaccumulation; Toxicokinetics - One Compartment Model.

Self-Study: Biomagnification - Factors that influence Bioaccumulation

UNIT – IV NATURE OF TOXICITY (15 HRS)

Toxicodynamics – introduction; Mechanisms of Toxicity of Pollutant-Organism level – Mortality, Disease Susceptibility, Behaviour, Cancer, Reproduction and development; Organ level; Environmental Risk Assessment.

UNIT – V METHODS OF TESTING (15 HRS)

Organization for Economic Cooperation and Development (OCED) – Guidelines.Toxicity Test - Acute and Chronic Toxicity –LC_{50}, EC_{50}, LOEC and NOEC. Biomarkers – Histology, Biochemical (Glucose), Enzymes (AChE) and

genetic markers (Comet Assay). Receptors - Estrogen receptor (ER) and aryl hydrocarbon receptor (AHR).Ecological risk assessment. Ecotoxicogenomics – tools and applications.

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

Reference

1. Sateake M., Mido Y., Sethi. M.S., S. A. Iqbal, Yasuhisa K and S. Taguchi. Environmental Toxicology. 2001. Second Edition .Discovery Publishing House, New Delhi – Tarun Offset Printers, Maujpur.
2. Ernest Hodgson 2004. A Textbook of Modern Toxicology. Third Edition. Edited By Ernest Hodgson. A John Wiley & Sons, Inc., Publication. New Jersey. Isbn 0-471-26508-X 1.
3. Walker CH, Hopkin SP, Sibly RM, Peakall DB. Principles of Ecotoxicology. 2nd edition. Taylor & Francis Group, 2001.
4. Casarett&Doull's Essentials of Toxicology. 3rd edition. Klaassen CD, Watkins JB. McGraw Hill, 2015. Also available on libraries.rutgers.edu (via accespharm) at https://bit.ly/3o0Tas
5. Omkar. Concepts of Toxicology. 2003. Publishing Soluyiyon, Jalandhar -144001.pp – 264.

DIGITAL OPEN EDUCATIONAL RESOURCES

1. https://www.niehs.nih.gov/health/topics/science/toxicology/index.cfm
2. https://www.toxicology.org/
3. https://www.epa.gov/chemical-research/ecotoxicology-ecotox-knowledgebase
4. http://npic.orst.edu/factsheets/ecotox.html
5. https://www.thebts.org/careers/ecotoxicology/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 BASICS OF TOXICOLOGY				
1.1	Definition, History, Scope	2	Chalk & Talk	Black Board
1.2	Importance of Ecotoxicology	1	Chalk & Talk	LCD
1.3	Classification of Environmental toxicants – food	2	Lecture	PPT & White board
1.4	Classification of Environmental toxicants atmosphere and hydrosphere	3	Discussion	LCD
1.5	Dose-Response Relationship-	2	Discussion	LCD
1.6	concept, assumption, measurement and curves -	3	Lecture	Black Board
1.7	factors influencing Dose-Response relationship.	2	Chalk & Talk	Black Board
UNIT -2 TRANSPORT AND FATE OF TOXICANTS IN THE ENVIRONMENT				
2.1	Transport and Fate of Toxicants in the Environment	1	Lecture	Green Board Charts
2.2	Source of toxicants to the Environment	2	Chalk & Talk	Green Board
2.3	transport Process – Advection and diffusion.	2	Chalk & Talk	Black Board

2.4	Equilibrium Partitioning – Air and Water partitioning.	2	Chalk & Talk	Black Board
2.5	Transformation Processes – reversible and irreversible reactions.	2	Lecture	PPT & White board
2.6	Environmental Persistence – abiotic degradation,	2	Lecture	Green Board
2.7	Biotic degradation	2	Chalk & Talk	Green Board
2.8	non -degradative elimination process.	2	Chalk & Talk	Black Board
UNIT -3 TRANSLOCATION OF TOXICANTS				
3.1	Introduction to ADME	1	Chalk & Talk	Black Board
3.2	Absorption, Distribution, Metabolism (Phase I and II) and Excretion/Elimination of Xenobiotics	6	Chalk & Talk	LCD
3.3	Barriers of translocation.	1	Lecture	PPT & White board
3.4	Ecological magnification	2	Discussion	LCD
3.5	Factors that influence Bioaccumulation;	2	Discussion	LCD
3.6	Toxicokinetics - One Compartment Model.	3	Lecture	Black Board

UNIT – 4 NATURE OF TOXICITY				
4.1	Toxicodynamics – introduction	1	Chalk & Talk	Black Board
4.2	Mechanisms of Toxicity of Pollutant	2	Chalk & Talk	LCD
4.3	Organism level – Mortality, Disease Susceptibility, Behaviour, Cancer,	2	Chalk & Talk	Black Board
4.4	Reproduction and development;	1	Chalk & Talk	Black Board
4.5	Organ level	4	Chalk & Talk	PPT
4.6	Environmental Risk Assessment.	2	Chalk & Talk	LCD
UNIT -5 METHODS OF TESTING				
5.1	Toxicity Test – OECD guidelines	1	Chalk & Talk	Black Board
5.2	Acute and Chronic Toxicity	2	Chalk & Talk	LCD
5.3	LC_{50}, EC_{50}, LOEC and NOEC.	2	Discussion	Black Board
5.4	Biomarkers – Histology, Biochemical, Enzymes and genetic markers.	5	Lecture	PPT & White board
5.5	Receptors - Estrogen receptor (ER) and aryl hydrocarbon receptor (AHR).	2	Lecture	PPT & White board

5.6	Ecological risk assessment .Ecotoxicogenomics – tools and applications.	3	Chalk & Talk	Black Board

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Summarize the scope, importance, types and dose – response relationship of environmental toxicants.	**K1**	PSO1, PSO2 PSO5 & PSO11
CO 2	Explain the transport and fate of toxicants in the environment.	**K2**	PSO1, PSO6, PSO7 & PSO11
CO 3	Organize the events in the translocation of toxicants.	**K3**	PSO1, PSO2, PSO3,PSO5 & PSO11
CO 4	Analyse the nature of toxicity at organism, Organ and environmental level.	**K4**	PSO1, PSO2 , PSO5 & PSO11
CO 5	Assess the various methods of testing environmental toxicants.	**K5**	PSO1, PSO2, PSO5 & PSO11

Mapping of COs with PSOs

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	3	3	1	2	2	2	2	1	1	1	3	1
CO2	3	2	1	2	2	3	3	1	1	1	3	1
CO3	3	3	1	2	2	2	3	1	1	1	3	1
CO4	3	3	1	2	2	2	1	1	1	1	3	1
CO5	3	3	3	1	2	2	2	2	2	1	3	1

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	1	2
CO2	3	3	1	2
CO3	3	2	1	2
CO4	3	2	2	2
CO5	3	3	3	2

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:

Dr. N. Nagarani

Forwarded By

HOD'S Signature& Name

I M. Sc.

SEMESTER –II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	23PG1ZAE	**Sericulture**	**Lecture**	**2**	**2**

COURSE DESCRIPTION

This course provides the knowledge of rearing of silkworm to produce raw silk.

COURSE OBJECTIVES

- Students should know basic concepts and techniques in Sericulture.
- Motivate young minds to become an entrepreneur for practicing
- sericulture as cottage industry.
- Gain knowledge about the diseases that affect silkworms.
- Know the steps involved in rearing and reeling process.

UNITS:

UNIT – I **(6 HRS.)**

Introduction to textile fibers; types- natural and synthetic fibers; sources of silk fiber- Tasar, Muga, Anaphe, Gonometa, Fagara, spider and mussel; properties and importance of silk fiber. History, development, status, characteristics and advantages of sericulture in India.Self –study - Binomial Nomenclature

UNIT – **(6 HRS.)**

Host plants; Moriculture- distribution, morphology, propagation- seedling, cutting, grafting, layering and micropropagation methods, maintenance- irrigation, manuring and pruning, pests and diseases of mulberry.Self –study - General characters of Protozoa

UNIT - III **(6 HRS.)**

Bombyx mori- morphology, anatomy, life cycle, geographical locations, larval moults, voltinism, indigenous and commercial races.Diapause.Egg-storage and transportation.

UNIT - IV (6 HRS.)

Rearing houses and equipment.Rearing operations- disinfection, brushing, feeding and spacing. Moulting and spinning. Harvest. Rearing methods- chawki, lasso, showa, shelf-rearing, floor-rearing and shoot rearing. Diseases of *Bombyx mori*- protozoan, bacterial, viral and fungal. Pests of silkworm- Uzi fly, desmestids, mites, ants, nematodes, aves and mammals.

UNIT – V (6 HRS.)

Physical and commercial characteristics of cocoons.Cocoon harvesting and marketing. Cocoon sorting, stifling, deflossing, riddling, cooking, brushing, reeling and re-reeling. Weaving.By-products of sericulture industry.

TEXT BOOKS:

1. G. Ganga and J. Sulochana Chetty. 2019. An introduction to sericulture, 2nd edition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

1. M. Johnson and M. Kesary. 2019. Sericulture, Saras publication, Tamilnadu.
2. Singh, Amardev & Ravinder Kumar. 2013. Sericulture handbook Vol 1, Biotech.
3. M. Madan Mohan Rao. An Introduction to Sericulture, 2nd edition, BS Publications.

DIGITAL OPEN EDUCATIONAL RESOURCES

1. https://agritech.tnau.ac.in/sericulture/
2. https://csb.gov.in/
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7904692/
4. CBCS Curriculum for B.Sc Zoology 242
5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3115026/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1				
1.1	Introduction to textile fibers; types- natural and synthetic fibers.	1	Chalk & Talk	Black Board
1.2	sources of silk fiber- Tasar, Muga, Anaphe, Gonometa, Fagara, spider and mussel	2	Chalk & Talk	Black Board
1.3	properties and importance of silk fiber	1	Lecture	PPT &White Board
1.4	History, development, status of sericulture in India	1	Lecture	PPT & White board
1.5	characteristics and advantages of sericulture in India	1	Chalk & Talk	Black Board
UNIT -2				
2.1	Host plants; Moriculture-distribution, morphology	1	Chalk & Talk	Green Board
2.2	propagation- seedling, cutting, grafting, layering and micropropagation methods	2	Chalk & Talk	Black Board
2.3	maintenance- irrigation, manuring and pruning	2	Chalk & Talk	Black Board

2.4	pests and diseases of mulberry	2	Chalk & Talk	Black Board
UNIT -3				
3.1	*Bombyx mori*- morphology, anatomy, life cycle	2	Lecture	PPT
3.2	geographical locations, larval moults, voltinism, indigenous and commercial races.	2	Lecture	PPT & White board
3.3	Diapause. Egg-storage and transportation	2	Lecture	LCD
UNIT -4				
4.1	Rearing houses and equipment. Rearing operations- disinfection, brushing, feeding and spacing..	2	Chalk & Talk	Black Board
4.2	Moulting and spinning. Harvest. Rearing methods- chawki, lasso, showa, shelf-rearing, floor-rearing and shoot rearing.	1	Lecture	LCD
4.3	Diseases of *Bombyx mori*- protozoan, bacterial, viral and fungal.	2	Discussion	Google classroom

4.4	Pests of silkworm- Uzi fly, desmestids, mites, ants, nematodes, aves and mammals	1	Lecture	LCD
5.1	Physical and commercial characteristics of cocoons.	2	Chalk & Talk	Black Board
5.2	Cocoon harvesting and marketing. Cocoon sorting, stifling, deflossing, riddling, cooking, brushing, reeling and re-reeling.	2	Chalk & Talk	Black Board
5.3	Weaving. By-products of sericulture industry.	2	Chalk & Talk	Black Board

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Summarize the history, scope, source, types, importance and advantage of silk fibre in India.	**K1, K2 & K3**	**PSO1**
CO 2	Explain the distribution, morphology, cultivation techniques and disease of Mulberry plant.	**K3, K4 & K5**	**PSO1, PSO3 & PSO4**
CO 3	Analyse the morphology, anatomy, life cycle of *Bombyx mori*	**K5**	**PSO1, PSO3 & PSO4**

CO 4	Explain the methods of rearing process.	**K4**	**PSO1, PSO3 & PSO4**
CO 5	Identify and explain the Cocoon harvesting and marketing.	**K3**	**PS01, PSO4**

Mapping of COs with PSOs

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	PSO 11	PSO 12
CO1	3	2	2	2	2	2	2	2	2	2	2	2
CO2	3	2	3	3	2	2	2	2	2	2	2	2
CO3	3	2	3	3	2	2	2	2	2	2	2	2
CO4	3	2	3	3	2	2	2	2	2	2	2	2
CO5	3	2	2	3	2	2	2	2	2	2	2	2

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	3	2	2	2
CO3	3	2	2	2
CO4	3	2	2	2
CO5	3	2	2	2

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**

♦ Weakly Correlated -**1**

COURSE DESIGNER:Forwarded By

HOD'S Signature
& Name

SEMESTER – II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	23PG2Z4	Cellular and Molecular Biology	Theory	6	5

COURSE DESCRIPTION

This course deals with the central dogma of molecular biology and to understand the basis of heredity.

COURSE OBJECTIVES

- Understand the general concepts of cell and molecular biology.
- Understand the general concepts of cell and molecular biology. cellular structures influencing functional features.
- Perceive the importance of physical and chemical signals at the molecular level resulting in modulation of response of cellular responses.
- Updated the knowledge on the rapid advances in cell and molecular biology for a better understanding of onset of various diseases including cancer.

UNITS

Unit IGeneral features of the cell (15 Hrs.)

Basic structure of prokaryotic and eukaryotic cells - Protoplasm and deutroplasm - cell organelles; cell theory; Diversity of cell size and shapes.

Unit IICellular organization (15 Hrs.)

Membrane structure and functions - Structure of model membrane, lipid bilayer and membrane proteins diffusion, osmosis, ion channels, active transport, ion pumps, mechanism and regulation of intracellular transport, electrical properties of membranes. Structure and functions of Intracellular organelles: Nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles and chloroplasts.

Unit IIICell division and Cell cycle (15 Hrs.)

Mitosis and meiosis, their regulation, steps in cell cycle and control of cell cycle. Molecular biology of cell: Structure of DNA and RNA; Process of DNA replication, transcription and translation in pro- and eukaryotic cells; Genetic maps

Unit IV Cell communication and cell signalling (15 Hrs.)

Membrane- associated receptors for peptide and steroid hormones - signaling through G-protein coupled receptors, signal transduction pathways. General principles of cell communication: extracellular space and matrix, interaction of cells with other cells and non-cellular structures.

Unit VCancer cells (15 Hrs.)

Characteristic features of normal and cancer cells; Carcinogens: types and cancer induction; Metastasis; Oncogenes and tumor suppressor genes, apoptosis; therapeutic interventions of uncontrolled cell growth.

REFERENCES:

Text Books

1. Plopper, G., D. Sharp, and E. Sikorski. 2015. Lewin's Cells (Third Edition), Jones & Bartlett, New Delhi, pp-1056
2. Plopper, G. 2013. Principles of Cell Biology, Jones & Bartlett, Maryland, pp-510

References Books

1. Karp, G. 2010. Cell Biology (Sixth Edition), John Wiley & Sons, Singapore, pp-765.
2. Lodish, H., C. A. Kaiser, A. Bretscher, *et al.*, 2013. Molecular Cell Biology (Seventh Edition), Macmillan, England, pp-1154
3. De Robertis, E.D.P. and E. M. F. De Robertis Jr, 1987. Cell and Molecular Biology. Info-Med, Hong Kong, pp-734
4. Abbas, A. K., A. H. Lichtman and S. Pillai, 2007, Cell and Molecular Immunology (Sixth Edition), Saunders, Philadelphia, pp-566
5. Loewy, A.G., P. Siekevitz and J. R. Menninger, *et al.*, 1991, Cell Structure and Function
(Third Edition), Saunders, Philadelphia, pp-947
6. Watson, J. D., N.H. Hopkins, J.W. Roberts, *et al.*, 1987, Molecular Biology of the Gene (Fourth Edition), Benjamin/Cummings, California, pp-1163
7. Han, S. S. and J. Holmstedt. 1979, Cell Biology, McGraw Hill, pp-319
8. Alberts, B., A. Johnson, J. Lewis, *et al.*, 2015, Molecular Biology of the Cell (Sixth Edition), Garland Science, New York, pp-1342

9. Clark, D.P., 2005. Molecular Biology, Elsevier, China, pp-784
10.Tropp, B. 2008. Molecular Biology Genes to Proteins (Third Edition), Jones & Bartlett, US, pp-1000

Web Resources

DIGITAL OPEN EDUCATIONAL RESOURCES

6. https://bio.libretexts.org/Bookshelves/Cell_and_Molecular_Biology
7. https://www.cellmolbiol.org/
8. https://uwm.edu/biology/research/cell-and-molecular-biology/
9. https://www.omicsonline.org/cellular-and-molecular-biology.php
10. https://www.ccmb.res.in/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1				
1.	Basic structure of prokaryotic and eukaryotic cells -	5	Chalk&Talk, PPT	White Board, Black Board, LCD projector
2.	Protoplasm and deutroplasm - cell organelles; cell theory; Diversity of cell size and	5	Chalk&Talk, PPT	Green Board, Black Board, LCD projector
3.	Diversity of cell size and shapes.	5	Chalk&Talk, PPT	Smart Board

UNIT II				
4.	Membrane structure and functions - Structure of model membrane, lipid bilayer and membrane	3	Chalk&Talk, PPT	Green Board, Black Board, LCD projector
5.	proteins diffusion, osmosis, ion channels, active transport, ion pumps,	4	Chalk&Talk, PPT	Smart Board, Green Board
6.	mechanism and regulation of intracellular transport, electrical properties of membranes.	4	Chalk&Talk, PPT	Smart Board, Green Board
7.	Structure and functions of Intracellular organelles: Nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles and chloroplasts.	4	Chalk&Talk, PPT	Smart Board, Green Board, Biovisual Charts
UNIT III				
8.	Mitosis and meiosis, their regulation, steps in cell cycle and control of cell cycle.	3	Chalk&Talk, PPT	Green Board, Black Board, LCD projector
9.	Molecular biology of cell: Structure of DNA and RNA;	4	Chalk&Talk, PPT	Smart Board, Green Board

10.	Process of DNA replication, transcription and translation in pro- and eukaryotic cells;	4	Chalk&Talk, PPT	Smart Board, Green Board
11.	Genetic maps	4	Chalk&Talk, PPT	Smart Board, Green Board, Biovisual Charts
UNIT IV				
12.	Membrane- associated receptors for peptide and steroid hormones -	5	Chalk&Talk, PPT	Green Board, Black Board, LCD projector
13.	signaling through G-protein coupled receptors, signal transduction pathways.	5	Chalk&Talk, PPT	Smart Board, Green Board
14.	General principles of cell communication: extracellular space and matrix, interaction of cells with other cells and non-cellular structures.	5	Chalk&Talk, PPT	Smart Board, Green Board
UNIT V				
15.	Characteristic features of normal and cancer cells;.	5	Chalk&Talk, PPT	Green Board, Black Board,

				LCD projector
16,	Carcinogens: types and cancer induction; Metastasis;	5	Chalk&Talk, PPT	Smart Board, Green Board
	Oncogenes and tumor suppressor genes, apoptosis; therapeutic interventions of uncontrolled cell growth	5	Chalk&Talk, PPT	Smart Board, Green Board

Components	**Marks**	**Converted Marks**
T1	**30**	**15**
T2	**30**	
Assignment		**3**
Quiz / Seminar		**5**
Attendance		**2**
	Total	**25 Marks**

EVALUATION PATTERN

MARKS		
CIA	**ESE**	**Tota l**
25	**75**	**100**

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Understand the general concepts of cell and molecular biology.	K2	PO1
CO 2	Understand the general concepts of cell and molecular biology. cellular structures influencing functional features.	**K1& K2**	PO1, PO2
CO 3	Perceive the importance of physical and chemical signals at the molecular level resulting in modulation of response of cellular responses.	**K3 & K4**	PO4, PO6
CO 4	Updated the knowledge on the rapid advances in cell and molecular biology for a better understanding of onset of various diseases including cancer.	**K5**	PO4, PO5, PO6
CO 5	Understand the general concepts of cell and molecular biology.	**K2**	PO3, PO8

Mapping COs Consistency with PSOs

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

S-Strong(3) M-Medium (2) L-Low (1) B N

Mapping of COs with POs

CO / PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10
CO 1	L	L	L	L	S	S	S	M	M	M
CO 2	M	M	M	S	S	S	S	M	S	M
CO 3	S	S	S	M	M	S	M	M	L	S
CO 4	M	M	S	L	S	S	L	M	S	S
CO 5	S	M	M	S	S	S	S	M	S	S

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

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SEMESTER – II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	23PG2Z5	Developmental Biology	Theory	6	5

COURSE DESCRIPTION

This Course focuses on the developmental process from a single egg tozygote by fertilization, into blastula by Cleavage, followed by Gastrulationinto Gastrula. From Gastrula, organ forming rudiments are formed, whichgive rise to the Organ Systems of the Organism.

COURSE OBJECTIVES

Imparts knowledge on the developmental process from a single egg to foetus,then in an adult.

UNITS

Unit I

Pattern of animal development: Chief events in animal development; History of thoughts and conceptual developments. Gametogenesis: Origin of germ cells, permatogenesis - Sperm morphology in relation to the type of fertilization, Oogenesis - Oogenesis in insects and amphibians; Composition and synthesis of yolk in invertebrates (insects and crustaceans) and vertebrates; Genetic control of vitellogenin synthesis in amphibians.

Unit II

Fertilization: Sperm aggregation, Sperm activation, Chemotaxis, Sperm maturation and capacitaion in mammals, Acrosome reaction. Sperm – egg interaction. Sperm entry into the egg - Egg activation - Intracellular calcium release - Cortical reaction - Physiological polyspermy - Fusion of male and female pronuclei - Post fertilization metabolic activation - Parthenogenesis

Unit III

Cleavage and gastrulation: Pattern of embryonic cleavage, mechanisms of cleavage, mid blastula transition - Determinate and regulatory embryos, Factors affecting gastrulation, mechanisms and types of gastrulation in respective animal embryos (Sea urchin, Amphioxus, Amphibians, Aves, Mammals); Fate maps - (Amphibian and Chick), Epigenesis and preformation – Formation of primary germ layers.

Unit IV

Embryonic Development; Embryonic development of fish and birds, formation of extra embryonic membranes in mammalian – Organogenesis - Development of endodermal, mesodermal and ectodermal derivatives. Embryonic Induction and neurulation; Formation and migration of neural crest cells - types of neural crest cells and their patterning - primary and secondary neurulation. Gene and development; Anterior- posterior axis in determination in drosophila, Maternal effect genes - Bicoid and Nanos proteins; Generation of dorsal - ventral polarity- Genetic control of segmentation – Gap genes; pair rule genes; Homeotic genes.

Unit V

Post embryonic development metamorphosis: Endocrine control of metamorphosis in insect and amphibian - Endocrine control of moulting and growth in crustaceans and insects - Neoteny and pedogenesis. Regeneration: Formation of ectodermal cap and regeneration blastema – Types of regeneration in planaria, Regenerative ability in different animal groups, Factors stimulating regeneration – Biochemical changes assosciated with regeneration. Aging and senescences: Biology of senescences- cause of aging-mechanism involved in apoptosis. Experimental Embryology: Mammalian reproduction: Mammalian reproductive cycle, Hormonal regulation, Endocrine changes associated with normal pregnancy, Induced ovulation in humans – Cryopreservation of gametes/embryos - Ethical issues in cryopreservation

REFERENCES:

1.Balinsky,B. I. 1981. Introduction to Embryology (5th Edition), CBS College Publishers, New York, pp-782.
2.Gilbert. S. F. 2006. Developmental Biology, 8th Edition, INC Publishers, USA, pp-785.
3.Berrill, N.J. 1974. Developmental Biology, Tata Mc-Graw Hill Publications, New Delhi, pp-535.
4.Tyler, M.S. 2000. Developmental Biology - A Guide for Experimental Study, Sunderland, MA, pp-208.
5.Subramoniam, T. 2011. Molecular Developmental Biology (2nd Edition), Narosa Publishers, India, pp-364.
6. Wilt, F.H. and N.K. Wessel. 1967. Methods in Developmental Biology, Thomas Y Crowell, New York.

7. Slack J.M.W. 2012. Essential Developmental Biology (3rd Edition), Wily-Blackwell Publications, USA, pp-496.
8. Mari-Beffa, M. and J. Knight. 2005. Key Experiments in Practical Developmental Biology, Cambridge University Press, UK, pp-404.

Web Resources
DIGITAL OPEN EDUCATIONAL RESOURCES

1. www.easybiologyclass.com › developmental-biology-e
2. www.studocu.com › document › lecture-notes › view
3. ocw.mit.edu › courses › 7-22-developmental-biology-f.

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1				
1.1	Chief events in animal development	2	Lecture	Black Board
1.2	History of thoughts and conceptual developments.	3	Lecture	Black Board
1.3	Gametogenesis: Origin of germ cells, Spermatogenesis - Sperm morphology in relation to the type of fertilization	4	Chalk & Talk	Black Board
1.4	Oogenesis - Oogenesis in insects and amphibians; Composition and synthesis of yolk in invertebrates (insects and crustaceans) and vertebrates	4	Lecture	LCD
1.5	Genetic control of vitellogenin synthesis in amphibians.	2	Lecture	Black Board
UNIT -2 Fertilization				
2.1	Sperm aggregation, Sperm activation, Chemotaxis, Sperm maturation and capacitaion in mammals	2	Lecture	LCD
2.2	Acrosome reaction. Sperm – egg interaction. Sperm entry into the egg - Egg activation - Intracellular calcium release	2	Chalk & Talk	Black Board

2.3	Cortical reaction - Physiological polyspermy - Fusion of male and female pronuclei	2	Lecture	LCD
2.4	Post fertilization metabolic activation	2	Lecture	LCD
2.5	Parthenogenesis	2	Lecture	LCD
UNIT -3 Cleavage and gastrulation				
2.1	Pattern of embryonic cleavage, mechanisms of cleavage, mid blastula transition	4	Chalk & Talk	Black Board
3.2	Determinate and regulatory embryos, Factors affecting gastrulation, mechanisms and types of gastrulation in respective animal embryos (Sea urchin, Amphioxus, Amphibians, Aves, Mammals)	5	Lecture	LCD
3.3	Fate maps in Amphibian and Chick	3	Lecture	LCD
3.4	Epigenesis and preformation – Formation of primary germ layers	3	Lecture	LCD
UNIT -4 Embryonic Development				
4.1	Embryonic development of fish and birds, formation of extra embryonic membranes in mammalian	3	Lecture	LCD

4.2	Organogenesis - Development of endodermal, mesodermal and ectodermal derivatives.	2	Lecture	LCD
4.3	Embryonic Induction and neurulation; Formation and migration of neural crest cells - types of neural crest cells and their patterning - primary and secondary neurulation.	4	Lecture	LCD
4.4	Gene and development; Anterior- posterior axis in determination in drosophila	2	Lecture	LCD
4.5	Maternal effect genes - Bicoid and Nanos proteins; Generation of dorsal - ventral polarity- Genetic control of segmentation – Gap genes; pair rule genes; Homeotic genes.	4	Lecture	LCD
UNIT -5 Post embryonic development				
5.1	**Metamorphosis:** Endocrine control of metamorphosis in insect and amphibian - Endocrine control of moulting and growth in crustaceans and insects - Neoteny and pedogenesis.	3	Lecture	LCD
5.2	**Regeneration:** Formation of ectodermal cap and	4	Lecture	LCD

	regeneration blastema – Types of regeneration in planaria, Regenerative ability in different animal groups, Factors stimulating Regeneration – Biochemical changes assosciated with regeneration.			
5.3	Aging and senescences: Biology of senescences- cause of aging- mechanism involved in apoptosis.	2	Lecture	LCD
5.4	Experimental Embryology: Mammalian reproduction: Mammalian reproductive cycle, Hormonal regulation, Endocrine changes associated with normal pregnancy.	3	Lecture	LCD
5.5	Induced ovulation in humans – Cryopreservation of gametes/embryos - Ethical issues in cryopreservation	3	Lecture	LCD

Components	Marks	Converted Marks
T1	**30**	**15**
T2	**30**	
Assignment		**3**
Quiz / Seminar		**5**
Attendance		**2**

Total	25 Marks

EVALUATION PATTERN

MARKS		
CIA	ESE	Tota l
25	75	100

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Define the concepts of embryonic development	K1	PO1
CO 2	Observe various stages of cell divisions under microscope	K2 & K3	PO1, PO2
CO 3	Understand the formation of zygote	K4	PO4, PO6
CO 4	Differentiate the blastula and gastrula stages	K4 & K5	PO4, PO5, PO6
CO 5	Learn the distinguishing features of three different germ layers and formation of various tissues and organs	K4	PO3, PO8

Mapping COs Consistency with PSOs

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	S							
CO2	M	S						
CO3				S		S		

CO4				S	S	M		
CO5			S					S

S-Strong(3) M-Medium (2) L-Low (1) B N

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	S	M	M	M
CO2	S	M	M	M
CO3	S	M	M	M
CO4	S	M	M	M
CO5	S	M	M	M

Note: ♦ Strongly Correlated – **3**♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

COURSE DESIGNER:

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I M.Sc. Zoology

SEMESTER – II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	23PG2Z6	Lab Course in Cell Biology and Developmental Biology	Practical	6	4

COURSE DESCRIPTION

It includes cell biology experiments such as observation of mitotic stages in onion root tip and visualizing giant chromosome in *Chironomus*larva and isolation and estimation of DNA and RNA.

COURSE OBJECTIVES

- Acquire knowledge to differentiate the cells of various living organisms and become awares of physiological processes of cells e.g. cell divisions, various stages of fertilization and embryo development.
- Understand and observe as well as correctly identify different cell types, cellular structures using different microscopic techniques.
- Develop handling - skills through the wet-lab course.
- Learn the method of culturing of Drosophila and identification of their wild and mutant strains
- Acquire skills to perform human karyotyping and chromosome mapping to identify abnormalities

CELL AND MOLECULAR BIOLOGY

1. Determination of cell size using micrometer
2. Mitosis in root meristematic cells of plants
3. Identification of various stages of meiosis in the testes of grasshopper
4. Detection of polytene chromosome in salivary gland cells of the larvae of the Chironomus
5. Detection of sex chromatin
6. Identification of blood cells in the haemolymph of the of the cockroach
7. Isolation of genomic DNA from eukaryotic tissue
8. Isolation of total RNA from bacterial cells/tissues
9. Agarose gel electrophoresis of DNA
10. SDS-Polyacrylamide gel electrophoresis

DEVELOPMENTAL BIOLOGY

Gametogenesis - Observation of gametes from gonadal tissue sections

i. Oogenesis:

- ✔ Section through ovary of shrimp, fish, frog and mammals

ii Spermatogenesis:

- ✔ Section through testis of shrimp, fish, calotes and mammals

Fertilization

iii Induced spawning in polycheate worm *Hydroids elegans*

iv *In vitro* fertilization and development in a polycheate worm *Hydroids elegans*

v Observation of egg developmental stages in *Emerita emeritus*

Embryogenesis

vi Observation and whole mount preparation of the chick blastoderm - 18 hours of development

vii Chick embryonic stage - 24 hours of development

viii Chick embryonic stage - 48 hours of development

ix Chick embryonic stage - 72 hours of development

x Chick embryonic stage - 96 hours of development

Histological observation: Section through various developmental stages in chick embryo

Experimental Embryology

Regeneration in Frog Tadpoles

xi Blastema formation

xii Demonstration of regenerative process in tadpoleMetamorphosis

xiii Demonstration of metamorphosis in Frog Tadpole using exogenous IodineCryopreservation

xiv Demonstration of cryopreservation of gametes of fin fish/shell fish

REFERENCES:

1. Rajan S., Christy, S.R., (2011). *Experimental procedures in Life Sciences*, Anjana Book House, Chennai.

2. Sinha J., Chatterjee A.K., Chattopadhyay P., (2015). *Advanced Practical Zoology*, Books and Allied (P) Ltd., Calcutta.
3. Sambrook and Russel, (2001). *Molecular Cloning Laboratory Manual*, 3rd ed., Cold Spring Harbor Laboratory Press, New York.

DIGITAL OPEN EDUCATIONAL RESOURCES (DOER):

1. https://www.nature.com/articles/205313a0
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5361071/
3. https://www.oercommons.org/courses/imaging-dna-structure
4. https://www.ncbi.nlm.nih.gov/books/NBK26936/
5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1660553/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 Experiments				
1.1	Determination of cell size using micrometer	4	Lecture & Demonstration	Blackboard & Specimen
1.2	Mitosis in root meristematic cells of plants	4	Demonstration	Specimen
1.3	Identification of various stages of meiosis in the testes of grasshopper	4	Demonstration	Specimen
1.4	Detection of polytene chromosome in salivary gland cells of the larvae of the Chironomus	4	Demo	Specimen
1.5	Detection of sex chromatin	4	Demo	Specimen

1.6	Identification of blood cells in the haemolymph of the of the cockroach	4	Demo	Specimen
1.7	Isolation of genomic DNA from eukaryotic tissue	4	Hands on training	Tissue sample
1.8	Isolation of total RNA from bacterial cells/tissues	4	Hands on training	Calf Thymus DNA
1.9	Agarose gel electrophoresis of DNA	6	Hands on training	AGE
1.10	SDS-Polyacrylamide gel electrophoresis	6	Hands on training	SDS PAGE
DEVELOPMENTAL BIOLOGY				
2.1	i. Oogenesis: Section through ovary of shrimp, fish, frog and mammals.	5	Observation	Models, Microscope
2.2	Spermatogenesis: Section through testis of shrimp, fish, calotes and mammals	4	Observation	Models, Microscope
2.3	Induced spawning in polycheate worm *Hydroids elegans*	4	Observation	Models, Microscope
2.4	*In vitro* fertilization and development in a polycheate worm *Hydroids elegans*	4	Observation	Models, Microscope
2.5	Observation of egg developmental stages in *Emerita emeritus*	4	Observation	Models, Microscope

2.6	Observation and whole mount preparation of the chick blastoderm - 18 hours of development Chick embryonic stage - 24hours of development Chick embryonic stage - 48hours of development Chick embryonic stage - 72hours of development Chick embryonic stage - 96hours of development	6	Observation	Models, Microscope Specimens
2.7	Blastema formation	4	Observation	Models, Microscope Specimens
2.8	Demonstration of regenerative process in tadpoleMetamorphosis	4	Observation	Models, Microscope Specimens
2.9	Demonstration of metamorphosis in Frog Tadpole using exogenous IodineCryopreservation	6	Observation	Models, Microscope Specimens
2.10	Demonstration of cryopreservation of gametes of fin fish/shell fish	6	Observation	Models, Microscope Specimens

EVALUATION PATTERN

MARKS		
CIA	**ESE**	**Total**
25	**75**	**100**

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Identify various stages in mitosis and meiosis.	K3	PO1
CO 2	Detection of polytene chromosome in salivary gland cells of the larvae of the Chironomus	K3	PO1, PO2
CO 3	Organize the steps in isolation of genomic DNA and RNA	K3	PO3, PO4, PO5
CO 4	Analyse the steps and principles involved in Agarose gel electrophoresis and SDS-Polyacrylamide gel electrophoresis techniques.	K4	PO4, PO5, PO6
CO 5	Analyse the various developmental stages in Chick embryo	K4	PO1, PO2, PO3, PO8

Mapping with Programme Outcomes*

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	S	L	L	M
CO2	S	S	S	S	S	M	M	M	M	M
CO3	S	S	M	S	S	L	S	M	L	M
CO4	M	M	L	M	L	M	M	S	M	L
CO5	S	S	M	L	S	M	L	S	S	S

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4

CO1	**S**	**M**	**M**	**M**
CO2	**M**	**S**	**M**	**M**
CO3	**M**	**S**	**S**	**S**
CO4	**M**	**M**	**S**	**S**
CO5	**M**	**M**	**S**	**M**

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

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SEMESTER – II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	**23PG2ZE5**	**Economic Entomology**	**Theory**	**4**	**3**

COURSE DESCRIPTION

This course deals with the study of insects including systematic, beneficial insects, destructive insects, integrated pest management and insects of medical and veterinary importance.

COURSE OBJECTIVES

- To understand the structures and distinct features of invertebrate

phyla.

- To understand and able to distinguish the characteristic features of each phylum
- To understand the economic importance of invertebrates
- To understand the interaction of invertebrates with the environment.
- To understand the evolutionary position of different groups of invertebrates

UNITS

Unit I

Overview of insects and insect taxonomy: Insects and their biological success - Man and insects; Basic concepts in Insect Taxonomy and classification.

Unit II

Beneficial insects: Silkworms - types, life history, disease management and rearing methods - Types of honey bees, life history, social organization (colonies and caste system), honey bee care and management of bee hive - Lac insects-life history, lac cultivation; Pollinators, predators, parasitoids, scavengers, weed killers, soil-builders.

Unit III

Destructive insects: Insect pests - definition - Categories of pests - Types of damage to plants by insects - Causes of pest outbreak - Economic threshold level - Biology of the insect pests - Pests of paddy, cotton, sugarcane, vegetables, coconut and stored grains cereals.

Unit IV

Pest management/Control strategies: Methods and principles of pest control - Natural control, Artificial control, Merits and demerits or limitations of these methods in pest control - Development and uses of pest resistant plant varieties - Integrated pest management - Concepts and practice.

Unit V

Vector biology: Vectors of veterinary and public health importance - Mosquitoes as potential vectors of human diseases-control measures

REFERENCES:

Text Books

1. Ayyar, L.V. R. 1936. Hand book of Economic Entomology for South India. Narendra Publishing House. New Delhi, pp- 528.
2. Vasantharaj David, B. and V.V. Ramamurthy. 2016. Elements of Economic Entomology, Eighth Edition, Brillion Publishing, New York, pp-400.
3. Ross. H.H. 1965. A Text Book of Entomology, John Wiley & Sons Inc., New York, pp-746.

References Books

1. Chapman, R.F., S.J. SimpsonandA.E.Douglas. 2012. The Insects: Structure and Function, Fifth Edition, Cambridge University Press, pp-959.
2. Imms, A.D., O.W.Richards and R.G. Davies (Eds.) IMMS' General Textbook of Entomology, Volume I: Structure, Physiology and Development, pp-418; Volume 2: Classification and Biology, pp-934, Springer Netherlands.
3. Daly, H.V., J.T. Doyen and P.R. Ehrlich. 1978. Introduction to Insect Biology and Diversity. Mc Graw-Hill Kogakusha Ltd., Tokyo, pp-564.
4. Hill, D.S. 1974. Agricultural Insect Pests of the Tropics and Their Control. Cambridge University Press, New York, pp-746.
5. Krishnaswami, S. 1973. Sericulture Manual, Vol. I & II, Silkworm rearing, FAO Agricultural Science Bulletin, Rome.
6. Mani, M.S. 1982. General Entomology. Oxoford& IBH Publishing Co., pp-912.
7. Wigglesworth, V.B. 1972. The Principles of Insect Physiology, ELBS & Chapman and Hall, London, pp-827.

DIGITAL OPEN EDUCATIONAL RESOURCES

1. Vector- Definition, Features, Types, Examples, Applications, Limitations (microbenotes.com)
2. Vector Definition and Examples - Biology Online Dictionary
3. Beneficial Insects: Meet the Bugs That Will Help Your Garden (treehugger.com)
4. http://isca.in/AGRI_FORESTRY/Archive/v3/i5/5.ISCA-RJAFS-2015-012.pdf
5. https://oercommons.org/courses/beneficial-bug-scavenger-hunt

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 OVERVIEW OF INSECTS AND INSECT TAXONOMY				

1.1	Overview of insects and insect taxonomy:	1	Chalk and Talk	Black Board
1.2	Insects and their biological success -	2	Chalk and Talk	Black Board
1.3	Man and insects;.	3	Group Discussion	-
1.4	Basic concepts in Insect Taxonomy and classification	2	Lecture	PPT & White Board
UNIT -2 BENEFICIAL INSECTS				
2.1	Beneficial insects:Silkworms - types, life history, disease management and rearing methods -;	1	Chalk and Talk	Black Board
2.2	Types of honey bees, life history, social organization (colonies and caste system), honey bee care and management of bee hive	2	Lecture	PPT & White Board
2.3	Lac insects-life history, lac cultivation	3	Chalk and Talk	Black Board
2.4	Pollinators, predators, parasitoids, scavengers, weed killers, soil-builders.	2	Lecture	PPT & White Board
UNIT -3 DESTRUCTIVE INSECTS				
3.1	Destructive insects:Insect pests - definition - Categories of pests.	1	Chalk and Talk	Black Board

3.2	Types of damage to plants by insects - Causes of pest outbreak. Economic threshold level.	3	Chalk and Talk	Black Board
3.3	Biology of the insect pests - Pests of paddy, cotton, sugarcane	3	Lecture	PPT & White Board
3.4	Biology of the insect pests - Pests of vegetables, coconut and stored grains cereals	2	Chalk and Talk	Black Board
UNIT IV: PEST MANAGEMENT/CONTROL STRATEGIES				
4.1	Methods and principles of pest control - Natural control, Artificial control	4	Chalk and Talk	Black Board
4.2	Merits and demerits or limitations in methods of pest control	2	Group Discussion	-
4.3	Development and use of pest resistant plant varieties	3	Lecture	PPT & White Board
4.4	Integrated pest management - Concepts and practice.	3	Chalk and Talk	Black Board
UNIT V: VECTOR BIOLOGY				
5.1	Vector biology:Vectors of veterinary and public health importance - Mosquitoes as potential vectors of human diseases-control measures	3	Chalk and Talk	Black Board
5.2	Mosquitoes as potential vectors of human diseases-control measures	3	Lecture	PPT & White Board

Components	**Marks**	**Converted Marks**

T1	**30**	**15**
T2	**30**	
Assignment		**3**
Quiz / Seminar		**5**
Attendance		**2**
	Total	**25 Marks**

EVALUATION PATTERN

MARKS		
CIA	**ESE**	**Total**
25	**75**	**100**

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Understand taxonomy, classification and life of insects in the animal kingdom.	**K1 & K2**	PO1
CO 2	Know the life cycle, rearing and management of diseases of beneficial insects.	**K2 & K3**	PO1, PO2, PO3
CO 3	Know the type of harmful insects, life cycle, damage potential and management of pests including natural pest control	**K2 & K3**	PO3, PO4, PO5

CO 4	Recognize insects which act as vectors causing diseases in animals and human.	**K2 & K4**	PO4, PO5, PO6
CO 5	Overall understanding on the importance of insects in human life.	**K2 & K6**	PO1, PO2, PO3, PO5

Mapping COs Consistency with PSOs

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	**S**							
CO2	**M**	**S**						
CO3			**S**	**S**	**S**	**S**		
CO4			**S**	**S**	**S**	**M**		
CO5			**S**					**S**

S-Strong(3) M-Medium (2) L-Low (1) B N

Mapping with Programme Outcomes*										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO 7**	**PO 8**	**PO9**	**PO1 0**
CO1	M	S	M	S	M	M	M	S	L	M
CO2	S	S	M	S	S	S	S	S	S	L
CO3	S	M	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	M	M
CO5	S	S	S	M	M	S	M	L	S	M

*S - Strong; M - Medium; L-Low

COURSE DESIGNER:

Forwarded By

HOD'S Signature

& Name

Elective Course Discipline Specific

I M.Sc., ZOOLOGY

SEMESTER –II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	23P2ZE6	Microbiology	Lecture	4	3

COURSE DESCRIPTION

To understand the fundamentals of Microbial diversity and applications of microbes in Industry and Environment

COURSE OBJECTIVES

- To gain knowledge of microorganisms with particular emphasis on the nomenclature, classification and biology of bacteria, viruses, viriods and prions.
- To understand the microbial metabolism
- To provide an overview on the utilization and application of microbes in Industry.

UNITS

UNIT –I INTRODUCTION (12 HRS.)

History and Scope of Microbiology - Whittaker's Five Kingdom Concept - Classification according to Bergey's manual- Microscopy - Principle, Components and applications of Phase contrast microscope, Fluorescence microscope, Dark field Microscope and Electron microscope- SEM & TEM.

Self-study –History and Scope of Microbiology

UNIT –II BACTERIA (12 HRS.)

Morphological types - Cell shapes and arrangements - External cell structures - Pili, Flagella and Glycocalyx - Cell envelope - cell walls of Gram negative and Gram positive. Archaebacteria - Nuclear material – bacterial chromosomes and plasmids.Sterilization methods - Classification of Culture media - Growth Kinetics.

Self-study– Classification of Culture media (Simple, complex and special media with examples)

UNIT –III VIRUSES, VIRIODS & PRIONS (12 HRS.)

Brief outline on discovery of viruses, origin of viruses, Nomenclature and classification of viruses - ICTV system of classification, properties of viruses.Morphology and ultrastructure of viruses; viral genome (RNA, DNA); Structure and importance of Viriods, Prions.

Self-study– Nomenclature and classification of viruses

UNIT –IV MICROBIAL METABOLISM (12HRS.)

Nutritional Categories of microorganisms; Anaerobic Respiration; Photosynthesis in Cyanobacteria; cyclic and noncyclic

photophosphorylation; fixation of CO_2 - Calvin cycle; Assimilation of inorganic phosphorus and sulfur – Nitrogen fixation – Symbiotic and asymbiotic relationship.

Self-study - Nitrogen fixation

UNIT –V APPLIED MICROBIOLOGY (12HRS.)

Food Microbiology - Food spoilage - Preservation - Fermented foods - Microorganisms as source of food - Industrial Microbiology - Fermentation: alcoholic fermentation - Production of Antibiotics - Penicillin; Bioinsecticides – *Bacillus thuringiensis* - Brief note on Biopolymers, Biosurfactants, Bioremediation and Biosensors.

Self-study– Food Microbiology - Food spoilage – Preservation - Bioinsecticides – *Bacillus thuringiensis* - bioremediation

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

REFERENCES:

1. Presscott L.M, Harley J. P and Klein D. A., (1999) Microbiology, 4th ed., Mc-Graw Hill, United States.
2. Pommerville J. C., (2010). *Alcamo's Fundamentals of Microbiology*, 8th ed., Jones and Bartlett Publishers.
3. Ingraham J.L a23nd Ingraham C.A., (2005) *Microbiology- An Introduction*, India Binding House.
4. Ananthanarayanan R and Panicker C.K.J., (2005) *Textbook of Microbiology*, 7th ed., Orient Longman.
5. Tortora G.J., Funke B.R., Case C. L., (2005) *Microbiology*: *An Introduction, 8th Edition,* Benjamin Cummings.
6. Dubey R. C., and Maheswari D.K., (2004). *A Textbook of Microbiology, 6th ed.,* Chand and company Ltd.
7. Pelczar M.J., Chan E.C.S.,andKreig N.R.,(2001). *Microbiology*, *5th ed.,* Tata Mc Graw Hill, New Delhi.

DIGITAL OPEN EDUCATION RESOURCES (DOER):

1. https://openstax.org/details/books/microbiology
2. https://open.oregonstate.education/microbiology/front-matter/preface/
3. https://www.oercommons.org/courses/microbiology-4/view
4. http://www.oercommons.org/courses/textbook-of-bacteriology/view
5. https://www.oercommons.org/courses/kimball-s-biology-pages

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 INTRODUCTION				
1.1	History and Scope of Microbiology	2	Discussion	Black Board
1.2	Whittaker's Five Kingdom Concept -Protist, Fungi, Helminthes	2	Chalk &Talk	Black Board
1.3	Classification according to Bergey's manual	3	Chalk & Talk	LCD
1.4	Microscopy - Principle, Components and applications of Phase contrast microscope.	2	Lecture	PPT & White board
1.5	Fluorescence microscope	1	Lecture	Black Board
1.6	Dark field Microscope.	1	Lecture	PPT
1.7	Electron microscope- SEM &TEM	1	Discussion	Google classroom
UNIT -2 BACTERIA				
2.1	Morphological types	1	Chalk & Talk	Black Board
2.2	Cell shapes and arrangements - External cell structures - Pili, Flagella and Glycocalyx	3	Chalk & Talk	LCD

2.3	Cell envelope - cell walls of Gram negative, Gram positive & Archaebacteria	3	Lecture	PPT & White board
2.4	Nuclear material – bacterial chromosomes and plasmids.	1	Lecture	Black Board
2.5	Sterilization methods	1	Chalk & Talk	LCD
2.6	Classification of Culture media	1	Discussion	Black Board
2.7	Growth Kinetics	2	Lecture	Black Board
UNIT -3 VIRUSES, VIRIODS & PRIONS				
3.1	Brief outline on discovery of viruses, origin of viruses	1	Chalk &Talk	Black Board
3.2	Nomenclature and classification of viruses	2	Discussion	Black Board
3.3	Properties of viruses.	2	Chalk & Talk	LCD
3.4	Morphology and ultra-structure of viruses	3	Lecture	PPT & White board
3.5	Capsids and their arrangements; types of envelopes and their composition.	3	Lecture	Black Board
3.6	Viral genome (RNA, DNA)	2	Lecture	LCD
3.7	Structure and importance - Viriods, Prions,	2	Discussion	Google classroom
UNIT -4 MICROBIAL METABOLISM				
4.1	Nutritional categories of Microorganisms	1	Chalk & Talk	Black Board
4.2	Anaerobic Respiration	2	Chalk & Talk	LCD

4.3	Photosynthesis in Cyanobacteria	1	Lecture	PPT & White board
4.4	Cyclic and noncyclic photophosphorylation	2	Lecture	Black Board
4.5	Fixation of CO_2 - Calvin cycle	2	Lecture	PPT
4.6	Assimilation of inorganic phosphorus and sulphur	2	Discussion	Google classroom
4.7	Nitrogen fixation. – Symbiotic and asymbiotic relationship.	2	Discussion	Black Board
UNIT -5 APPLIED MICROBIOLOGY				
5.1	Food Microbiology - Food spoilage - Preservation	1	Discussion	Black Board
5.2	Fermented foods -Microorganisms as source of food	1	Chalk & Talk	Black Board
5.3	Industrial Microbiology Fermentation: Alcoholic fermentation	2	Chalk & Talk	LCD
5.4	Production of Antibiotics - Penicillin	2	Lecture	PPT & White board
5.5	Bioinsecticides – *Bacillus thuringiensis*	1	Lecture	LCD
5.6	Biopolymers	1	Lecture	Black Board
5.7	Biosurfactants	2	Discussion	Google classroom
5.8	Bioremediation	1	Lecture	Black Board
5.8	Biosensors	1	Discussion	LCD

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Describe the scope of microbiology, taxonomical classification, principle and components of different types of microscopes	**K3**	PSO1, PSO2, PSO5
CO 2	Classify bacteria based on morphology, biochemical characteristics and growth parameters	**K4**	PSO1, PSO2, PSO11
CO 3	Discuss the morphology and classification of viruses.	**K3**	PSO1, PSO4 PS05
CO 4	Explain the metabolism of bacteria	**K2**	PSO1, PS09
CO 5	Appraise the role of bacteria in food, industry, medicine, environment and agricultural microbiology	**K5**	PSO1, PS05, PSO6, PSO9

Mapping of COs with PSOs

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10	PSO 11	PSO 12
CO 1	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
CO 2	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**
CO 3	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

CO 4	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**
CO 5	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	**3**	**3**	**2**	**2**
CO2	**3**	**3**	**2**	**2**
CO3	**3**	**3**	**2**	**2**
CO4	**3**	**2**	**2**	**2**
CO5	**3**	**3**	**2**	**2**

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

COURSE DESIGNER:

Dr. Sr. BijiCyriac

Forwarded By

HOD'S Signature
& Name

I M.Sc. Zoology

SEMESTER – II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	23PG2ZE7	Research Methodology	Theory	4	3

COURSE DESCRIPTION

This course imparts the basic principle, methodology and applications of widely used instruments in biological sciences.

COURSE OBJECTIVES

- To understand the implications of GLP
- To learn the working principles of different instruments
- To gain the knowledge on techniques of histology and histochemistry
- To acquire knowledge on the basic principle and application of various modules of light and electron microscopy
- To appreciate the applications of tracer techniques and animal cell culture techniques

UNITS

UNIT –I INTRODUCTION TO GLP &BIOINSTRUMENTATION (12 HRS.)

Good laboratory practice (GLP) - pH, Electrodes and pH meter - Colorimeter and Spectrophotometry.

UNIT – II HISTOLOGY (12 HRS)

Histology, Histochemistry, Bioinformatics and Electron microscopy.

UNIT – IIIMICROSCOPY (12 HRS)

Light Microscopy, Bright field, Phase contrast, DIC & Fluorescence microscopy, wide field and Confocal microscopy.

UNIT – IVBIOLOGICAL TECHNIQUES (12 HRS)

Centrifuges, Chromatography, Electrophoresis, ELISA and blotting.

UNIT – V ANIMAL CELL CULTURE (12 HRS)

Principles and Applications of tracer techniques in biology, Animal cell culture techniques.

REFERENCES:

1. Wilson K and Walker J., (2013) *Principles and Techniques of Biochemistry and Molecular Biology, 7th ed.,* Cambridge University Press, New York.
2. Roe S., (2001) *Protein Purification Techniques – A Practical Approach, 2nd* ed., Oxford University Press.
3. Boyer R., (2000) *Modern Experimental Biochemistry, 3rd ed.,* Pearson Education Inc.
4. Wilson K and Kenneth H.G., (1992) *A Biologists Guide to Principles and Techniques of Practical Biochemistry, 3rd ed.*, Cambridge University Press, Cambridge, UK.
5. Satyanarayana U., and ChakrapaniU.(2014)*Biochemistry, 4th Revised ed,* Reprinted. Elsevier, Reed Elsevier India Private Limited, New Delhi and Books and Allied (P) Ltd., Kolkata.
6. Rastogi S.C. (2006) *Biochemistry, 2nded, 5th Reprint.* Tata McGraw-Hill Publishing Company Limited, New Delhi).
7. Lehninger L.A., Nelson D.L and Cox M.M. (2005) *Principles of Biochemistry, 5th ed.*, W.H.Freeman and Company, New York.
8. Conn E.E., Stumpf P.K., Bruening G and Doi R.H. (2004). *Outlines of Biochemistry, 5th ed.*, John-Wiley and Sons, Singapore.
9. Stryer L (2003) *Biochemistry, 5th ed.*, W.H.Freeman Publishers, New York.

10. Murray K.R., Granner D.K., Mayer A.P and RodwellV.W.(2000)*Harper's Biochemistry, 25th ed.*, Appleton and Lange.
11. Devlin M.T.(1997) *Textbook of Biochemistry with Clinical Correlations,* Wiley-Liss Pub, New York.
12. Montgomery R., Conway T.W., Spector A.A and Chapell D. (1996) *Biochemistry – A case oriented approach, 6th ed.,* Mosby Inc., London.
13. Pearse, A.G. 1968. Histochemistry: Theoretical and Applied, Vol. I, Third Edition, J & A Churchill Ltd, pp-758.
14. Lillie, R.D. 1954. Histopathologic Technic and Practical Histochemistry, Second Edition, Blakiston, New York, pp-715.
15. Hoppert, M. 2003. Microscopic Techniques in Biotechnology, Wiley-VCH GmbH, Weinheim, Germany, pp-330.
16. Chandler, D.E. and Roberson R.W. 2009. Bioimaging: Current Concepts in Light and Electron Microscopy, Jones and Bartlet Publishers, Sudbury, MA, USA, pp440.
17. Engelbert, B. 1960. Radioactive Isotopes in Biochemistry, Elsevier Applied Science, pp-376.
18. Wolf, G. 1964. Isotopes in Biology, Academic Press, pp-173.
19. Srivastava, B. B. 2005. Fundamentals of Nuclear Physics, Rastogi Publications, pp-500.

Web Resources

DIGITAL OPEN EDUCATIONAL RESOURCES

1. http://amrita.olabs.edu.in/?sub=73&brch=8&sim=209&cnt=1
2. https://ocw.mit.edu/courses/materials-science-and-engineering/3-091sc-introduction-to-solid-state-chemistry-fall-2010/organic-materials/31-protein-structure/
3. https://openlab.citytech.cuny.edu/bio-oer/chemistry/biologically-important-macromolecules/proteins/protein-detection/
4. http://amrita.olabs.edu.in/?sub=79&brch=18&sim=236&cnt=1
5. http://amrita.olabs.edu.in/?sub=79&brch=17&sim=205&cnt=1

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 INTRODUCTION TO GLP & BIOINSTRUMENTATION				
1.1	Good laboratory practice (GLP)	5	Chalk & Talk	Black Board
1.2	pH, Electrodes and pH meter	3	Lecture	PPT
1.3	Colorimeter and Spectrophotometry.	4	Chalk & Talk	Green Board
UNIT -2 HISTOLOGY				
2.1	Histology	1	Lecture	Green Board
2.2	Histochemistry	3	Chalk & Talk	Green Board
2.3	Bioinformatics	4	Lecture	Smart Board
2.4	Electron microscopy	4	Lecture	Board
UNIT -3 MICROSCOPY				
3.1	Light Microscopy	1	Chalk & Talk	Black Board
3.2	Bright field, Phase contrast Microscopy	4	Lecture	LCD
3.3	DIC & Fluorescence microscopy,	4	Lecture	LCD
3.4	wide field and Confocal microscopy.	4	Lecture	LCD
UNIT -4 BIOLOGICAL TECHNIQUES				
4.1	Centrifuges	1	Chalk & Talk	Black Board
4.2	Chromatography	3	Chalk & Talk	Black Board
4.3	Electrophoresis	3	Chalk & Talk	Black Board

4.4	ELISA	2	Chalk & Talk	Black Board
4.5	Blotting techniques	3	Chalk & Talk	Black Board
UNIT - 5 ANIMAL CELL CULTURE				
5.1	Principles and Applications of tracer techniques in biology,	5	Chalk & Talk	Black Board
5.2	Principles and Applications of Animal cell culture techniques.	7	Lecture	Green Board

Components	**Marks**	**Converted Marks**
T1	**30**	**15**
T2	**30**	
Assignment		**3**
Quiz / Seminar		**5**
Attendance		**2**
	Total	**25 Marks**

EVALUATION PATTERN

MARKS		
CIA	**ESE**	**Total**
25	**75**	**100**

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	To understand the implications of GLP	**K1**	PO1
CO 2	To learn the working principles of different instruments	**K2**	PO1, PO2
CO 3	To gain the knowledge on techniques of histology and histochemistry	**K2 & K4**	PO4, PO6
CO 4	To acquire knowledge on the basic principle and application of various modules of light and electron microscopy	**K3 & K5**	PO4, PO5, PO6
CO 5	To analyse the applications of tracer teachniques and animal cell culture techniques	**K3 & K5**	PO3, PO8

Mapping COs Consistency with PSOs

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

S-Strong(3) M-Medium (2) L-Low (1) B N

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	2	3	2	2

CO2	2	3	2	2
CO3	2	3	2	2
CO4	2	3	2	2
CO5	2	3	2	2

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

COURSE DESIGNER:

Forwarded By

HOD'S Signature
& Name

Elective Course - Discipline Specific

I M.Sc., ZOOLOGY

SEMESTER –II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
PSZO	23PG2ZE8	Biophysics	Lecture	4	3

COURSE DESCRIPTION

Biophysics which is an inter disciplinary course, deals with the discipline concerned with the application of the principles and methods of physics and the other physical sciences to the solution of biological problems.

COURSE OBJECTIVES

- To imbibe the principles of physics involved in the structure elucidation of biomolecules
- To understand the principles of energy transformation in living systems
- To apply the use of modern physical instruments to unravel the importance of therapeutic radiology, in which the measurement of dose is critical to treatment, and in diagnostic radiology, particularly with techniques involving isotopes

UNITS:

UNIT-I: CHEMCAL BONDS AND MOLECULAR INTERACTIONS [12 HRS.]

Electron configuration of an atom: Covalent bond, hydrogen bond, Disulphide bond, Peptide bonds- Forces between Molecules: Electrostatic force, Van der Waal's forces, hydrophobic and hydrophilic - Biological importance and domains of Physics in Biology-Electrolytic dissociation and electrolytes:- Ionisation, Basis of acidity and Basicity, Bronsted Lowry

theory, strength of acids and bases, Henderson and Hasselbalch equation. Water as Dipole -Biological importance of water

Self-Study:-Water as Dipole -Biological importance of water

UNIT-II: THERMODYNAMICS AND BIOLOGICAL OXIDATION [12 HRS.

Laws of Thermodynamics: Concept of free energy and entropy, Exergonic and Endergonic reactions; Diffusion: Fick's Laws-I & II law, constant laws, Osmotic coefficient: Gibbs Donnan equilibrium- Oxidation and reduction reactions: Redox potentials in biological system- High energy phosphate group: ATP synthesis in mitochondria.

UNIT-III: INSTRUMENTATION [12 HRS.]

Principle, Components and Biological applications of Polarising microscope, Inverted microscope, Confocal and X-ray microscope, Flow cytometry. Spectrophotometry: Laws of absorption, complementary colours, Chromophore concept, Absorption spectrum, Wavelength selectors, Detection devices, amplification and read out. Chromatography: Paper chromatography, TLC and Column chromatography. Centrifugation: Principle, Types & Applications, Relative Centrifugal Force, Factors affecting sedimentation and types of centrifugation.

Self-Study: Principle, Components and Biological applications of Light microscope

UNIT-IV: PHOTO BIOPHYSICS [12 HRS.]

Electromagnetic spectrum: Components of EMR, Quantum theory of radiation, Biological application, Effects of UV on Biological systems - Radioactive isotopes: Measurements of radiation, Dosimetry, Cerenkov radiation, Gas ionization methods: Ionization chambers, proportional counters, GM tubes, Photographic methods: Autoradiography - Excitation

method: Liquid Scintillation counters; Use of isotopes as tracers in Biology; Safety aspects.

Self-Study:-Use of isotopes as tracers in Biology; Safety aspects, Effects of UV on Biological systems

UNIT-V: BIOPHYSICAL PRINCIPLES APPLIED TO PHYSIOLOGY [12 HRS.]

Biophysical aspects of vision: photoreceptors: simple and compound, structure and function of vertebrate eye, mechanism of conversion of light: Biophysical aspects of hearing, noise and speech-mechanism of hearing-auditory and non-auditory effects of noise pollution; stimulation to neuronal impulse - Nerve conduction: Neurotransmitters and Synapse, Conduction of nerve impulse.

Self-Study:-Neurotransmitters and Synapse

UNIT –VI DYNAMISM (Evaluation Pattern-CIA only)

REFERENCES:

1. Claycomb J.J, Tran J.Q.P., (2011) *Introductory Biophysics: Perspectives on the living state, Jones and Bartlett publishers*, New Delhi.
2. Upadhyay A, Upadhyay K and Nath N., (2007) *Biophysical chemistry Principles and Techniques, Himalaya Publishing House Pvt.* Ltd., Mumbai.
3. Narayanan P, (2007) *Essentials of Biophysics, New Age International (P) Ltd.,* Publishers, New Delhi.
4. Nolting B., (2005) *Methods in modern Biophysics, Springer (India) private Ltd.,* New Delhi.
5. Cotterill R., (2004) *Biophysics and Introduction, John Wiley and Sons* Ltd., printed in India by Replika press pvt. Ltd., Kundli
6. Agarwal S.K., (2005) *Advanced Biophysics, APH publishing corporation,* New Delhi.

7. Pattabhi V and Gautham N., (2004) *Biophysics*, Narosa Publishing House, New Delhi.

DIGITAL OPEN EDUCATION RESOURCES (DOER):

1. http://oer.iain-padangsidimpuan.ac.id/items/show/98
2. https://www.oercommons.org/authoring/15047-basic-thermodynamics/view
3. https://www.oercommons.org/courseware/lesson/56957
4. https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Supplemental_Modules_(Organic_Chemistry)/Fundamentals/Ionic_and_Covalent_Bonds
5. https://www.khanacademy.org/science/ap-biology/chemistry-of-life/introduction-to-biological-macromolecules/a/chemical-bonds-article

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1	**CHEMCAL BONDS AND MOLECULAR INTERACTIONS**			
1.1	Electron configuration of an atom: Covalent bond, hydrogen bond, Disulphide bond, Peptide bonds-	2	Discussion	Black Board
1.2	Forces between Molecules: Electrostatic force, Van der Waal's forces, hydrophobic and hydrophilic	1	Chalk & Talk	LCD
1.3	Biological importance and domains of Physics in Biology	1	Lecture	PPT & White board
1.4	Electrolytic dissociation and electrolytes:- Ionisation, Basis of acidity and Basicity,	1	Lecture	Smart Board

1.5	Bronsted Lowry theory, strength of acids and bases,	2	Lecture	Black Board
1.6	Henderson and Hasselbalch equation.	1	Chalk &Talk Discussion	Google classroom
1.7	Water as Dipole -Biological importance of water	3	Lecture	Black Board
UNIT-2 THERMODYNAMICS AND BIOLOGICAL OXIDATION				
2.1	Laws of Thermodynamics: Concept of free energy	2	Lecture	Green Board Charts
2.2	Entropy, Exergonic and Endergonic reactions,	1	Chalk & Talk	Green Board
2.3	Rate of reactions - Effect of sunlight and temperature on reactions	2	Discussion	Black Board
2.4	Energy of Activation: Arrhenius expression	1	Chalk & Talk	Green Board
2.5	Diffusion: Fick's Laws-I & II law,	2	Lecture	PPT & White board
2.6	constant laws, Osmotic coefficient	1	Lecture	Smart Board
2.7	Gibbs Donnan equilibrium-	1	Lecture	Black Board
2.8	Oxidation and reduction reactions: Redox potentials in biological system	1	Chalk & Talk Discussion	Google classroom

2.9	High energy phosphate group : ATP synthesis in mitochondria, ATP synthase.	1	Lecture	Black Board
UNIT-3 INSTRUMENTATION				
3.1	Principle, Components and Biological applications of Light microscope	1	Chalk &Talk	Black Board
3.2	Principle, Components and Biological applications of Polarising microscope	1	Chalk & Talk	LCD
3.3	Principle, Components and Biological applications of Inverted microscope	1	Lecture	PPT & White board
3.4	Principle, Components and Biological applications of Confocal microscope	1	Lecture	Smart Board
3.5	Principle, Components and Biological applications of X-ray microscope	1	Lecture	Black Board
3.6	Flow cytometry	1	Discussio n	Google classroom
3.7	Colorimetry and Spectrophotometry: Laws of absorption, complementary colours	1	Lecture	Black Board
3.7	Chromophore concept, Absorption spectrum, Wavelength selectors, Detection devices, amplification and read out	1	Lecture	Black Board
3.8	Chromatography: Paper chromatography	1	Lecture	Black Board
3.9	TLC	1	Lecture	PPT & White board

3.10	Column chromatography	1	Lecture	PPT & White board
3.11	Centrifugation: Principle, Types & Applications, Relative Centrifugal Force- Factors affecting sedimentation and types of centrifugation	1	Lecture	PPT &White board
UNIT-4 PHOTO BIOPHYSICS				
4.1	Electromagnetic spectrum: Components of EMR	1	Chalk &Talk	Black Board
4.2	Quantum theory of radiation	1	Chalk &Talk	LCD
4.3	Biological application	1	Lecture	PPT & White board
4.4	Effects of UV on Biological systems	1	Lecture	Smart Board
4.5	Radioactive isotopes: Measurements of radiation, Dosimetry	1	Lecture	Black Board
4.6	Cerenkov radiation and Interaction of radioactivity with matter	1	Discussio n	Google classroom
4.7	Gas ionization methods: Ionization chambers, proportional counters, GM tubes	2	Lecture	Black Board
4.7	Photographic methods: Autoradiography,	2	Lecture	Black Board
4.8	Excitation method: Liquid Scintillation counters	1	Lecture	Black Board

4.9	Use of isotopes as tracers in Biology; Safety aspects	1	Lecture	Black Board
UNIT-5 BIOPHYSICAL PRINCIPLES APPLIED TO PHYSIOLOGY				
5.1	Biophysical aspects of vision: photoreceptors: simple and compound	1	Chalk & Talk	Black Board
5.2	Structure and function of vertebrate eye,	1	Chalk & Talk	LCD
5.3	Mechanism of conversion of light stimulation to neuronal impulse	2	Lecture	PPT & White board
5.4	Biophysical aspects of hearing, noise and speech-mechanism of hearing-auditory and non-auditory effects of noise pollution	2	Lecture	Black Board
5.5	Nerve conduction: Neurotransmitters and Synapse	2	Lecture	Smart Board
5.6	Membrane potential, resting potential and action potential,	1	Lecture	Black Board
5.7	Action potentials in earthworm nerve fiber	2	Discussion	Google classroom
5.8	Muscle Contraction	2	Lecture	Black Board

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	Classify the chemical bonds and forces interacting between molecules and Determine the theories involved in acidity and basicity	**K2**	PSO1& PSO2
CO 2	Apply the principles of Thermodynamics and biological oxidation in living organisms	**K3**	PSO2
CO 3	Determine the principle, procedure, components involved and biological applications of Instruments	**K3**	PSO1
CO 4	Analyse the principle, properties, instrumentation and biological applications of Electromagnetic radiation	**K4**	PSO4
CO 5	Assess the principles of Photobiology in the Biophysical aspects of Vision and neurophysiology applied to the Animals	**K5**	PSO1 & PSO2

Mapping of COs with PSOs

CO /	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10	PSO 11	PSO 12

PSO												
CO1	3	3	2	2	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	2	2	2	2	2	2	2
CO3	3	2	2	2	2	2	2	2	2	2	2	2
CO4	2	2	2	1	2	2	2	2	2	2	2	2
CO5	3	3	2	2	2	2	2	2	2	2	2	2

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	3	2	2	2
CO2	3	2	2	2
CO3	3	2	2	2
CO4	3	3	3	2
CO5	3	3	2	2

Note: ♦ Strongly Correlated – **3** ♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

COURSE DESIGNER:

1. **Dr.N.MALATHI**

Forwarded By

HOD'S Signature
& Name

SEC -EDC

I M.Sc. Zoology

SEMESTER – II

For those who joined in 2023 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
PSZO	23PG2ZSE1	Poultry Farming	Theory	4	2

COURSE DESCRIPTION

The course has great potential for creating self-employment and businessopportunity

COURSE OBJECTIVES

- Enable the students to be familiarized with Poultry farming to become an entrepreneur.
- Know to manage and maintain Poultry farms.

UNITS

UNIT I **(12 Hrs)**

General introduction to Poultry farming - Definition of Poultry - Past and present scenario of Poultry industry in India - Principles of Poultry housing - Poultry houses - Systems of poultry farming

UNIT II **(12 Hrs)**

Management of Chicks - growers and layers - Management of Broilers. - Preparation of Project report for banking and insurance.

UNIT III **(12 Hrs)**

Poultry Feed management-Principles of feeding, Nutrient requirements for different stages of layers and broilers - Feed formulation and Methods of feeding.

UNIT IV **(12 Hrs)**

Poultry diseases-viral, bacterial, fungal and parasitic (two each); symptoms, control and management; Vaccination programme..

UNIT V **(12 Hrs)**

Selection, care and handling of hatching eggs - Egg testing. Methods of hatching.- Brooding and rearing -. Sexing of chicks. - Farm and Water Hygiene - Recycling of poultry waste.

REFERENCES:

References Books

1.Sreenivasaiah., P. V., 2015. Textbook of Poultry Science.1st Edition.Write & Print Publications, New Delhi 2.
2.Jull A. Morley, 2007. Successful Poultry Management.2nd Edition. Biotech Books, New Delhi"
3. Hurd M. Louis, 2003. Modern Poultry Farming.1st Edition.International Book Distributing Company, Lucknow."
4. Life and General Insurance Management"

Web Resources

DIGITAL OPEN EDUCATIONAL RESOURCES

1. 2. http://www.asci-india.com/BooksPDF/Small%20Poultry%20Farmer.pdf
2. 3.https://nsdcindia.org/sites/default/files/MC_AGR-Q4306_Small-poultry-farmer-.pdf
3. 4. http://ecoursesonline.iasri.res.in/course/view.php?id=335
4. 5. https://swayam.gov.in/nd2_nou19_ag09/preview
5. https://www.nio.org/
6. https://greatbarrierreef.org/

COURSE CONTENTS & LECTURE SCHEDULE:

Module No.	Topic	No. of Lectures	Teaching Pedagogy	Teaching Aids
UNIT -1 Introduction to Poultry Farming				

1.1	General introduction to poultry farming - Definition of Poultry - Past and present scenario of poultry industry in India.	6	Lecture	LCD
1.2	Principles of poultry housing - Poultry houses - Systems of poultry farming	6	Lecture	LCD
UNIT -2				
2.1	Management of chicks - growers and layers - Management of Broilers. -	7	Lecture	LCD
2.2	Preparation of project report for banking and insurance.	5	Lecture	LCD
UNIT -3 Poultry feed management				
3.1	Principles of feeding, Nutrient requirements for different stages of layers and broilers	7	Lecture	LCD
3.2	Feed formulation and Methods of feeding.	5	Lecture	LCD
UNIT -4Poultry diseases				
4.1	Poultry diseases-viral, bacterial, fungal and parasitic (two each); symptoms, control and management	7	Lecture	LCD
4.2	Vaccination programme.	5	Lecture	LCD

UNIT -5				
5.1	Selection, care and handling of hatching eggs - Egg testing.	4	Lecture	LCD
5.2	Methods of hatching - Brooding and rearing -. Sexing of chicks.	4	Lecture	LCD
5.3	Farm and Water Hygiene - Recycling of poultry waste.	4	Lecture	LCD

Components	Marks	Converted Marks
T1	**30**	**15**
T2	**30**	
Assignment		**3**
Seminar		**5**
Attendance		**2**
	Total	**25 Marks**

EVALUATION PATTERN

MARKS		
CIA	**ESE**	**Total**
25	**75**	**100**

COURSE OUTCOMES

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

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	To understand the various practices in Poultry farming. To know the needs for Poultry farming and the status of India in global market.	K2 & K3	PO1
CO 2	To be able to apply the techniques and practices needed or Poultry farming.	K1, K2 & K3	PO1, PO2
CO 3	To know the difficulties in Poultry farming and be able to propose plans against it.	K5 & K6	PO4, PO6
CO 4	To understand the various practices in Poultry farming. To know the needs for Poultry farming and the status of India in global market.	K2 & K3	PO4, PO5, PO6
CO 5	To be able to apply the techniques and practices needed or Poultry farming.	K1, K2 & K3	PO3, PO8

Mapping COs Consistency with PSOs

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	S							
CO2	M	S						
CO3				S		S		
CO4				S	S	M		
CO5			S					S

S-Strong(3) M-Medium (2) L-Low (1) B N

Mapping of COs with POs

CO/ PSO	PO1	PO2	PO3	PO4
CO1	S	M	M	M
CO2	S	M	M	M
CO3	S	M	M	M
CO4	S	M	M	M
CO5	S	M	M	M

Note: ♦ Strongly Correlated – **3**♦ Moderately Correlated – **2**
♦ Weakly Correlated -**1**

COURSE DESIGNER:

Forwarded By

HOD'S Signature
& Name