ST. JOSEPH'S COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

CUDDALORE – 1

DEPARTMENT OF ZOOLOGY

BOARD OF STUDIES

a) B.Sc., Zoology

b) M.Sc., Zoology

2024-2027

St. Joseph's College of Arts and Science (Autonomous)

Cuddalore -607001

Name of the Department : Department of Zoology

Details of the Expert Members in the Board of Studies

S.No.	Category	Name and Official Address	Phone No.& E-Mail ID
1.	**Chairman**	**Dr. P. Thenmozhi** Asst. Professor & Head, Department Of Zoology, St. Joseph's College of Arts & Science (Autonomous), Cuddalore-1	Mobile: 9442640469 E.mail:thenmozhi@sjctnc.edu.in
2.	**University Nominee**	**Dr. M. Muthulingam** Associate Professor, Department of Zoology, D.G. Govt. Arts College for Women, Mayiladuthurai	Mobile: 9843629002 E. mail: muthuau@rediffmail.com
3.	**Subject Experts**	**Dr.G.Chinnadurai** Associate Professor, Department of Zoology, Periyar Govt. Arts. College, Cuddalore-1	Mobile: 9442382913 E. mail: chinnadurai@pacc.in
4.	**Subject Experts**	**Dr. S. Muthalagi** Assistant Professor, PG and Research Department of Zoology, ThiruKolanjiappar Govt. Arts College, Virudhachallam Cuddalore 606001.	Mobile: 9486586092 E.mail : muthalagis@gmail.com

a) B.Sc., Zoology

Internal Members

S.No.	Category	Name and Official Address	Phone No.& E-Mail ID
1.	**Members (Internal)**	**Dr. A. Arulprakash** Asst. Professor, Department of Zoology, St. Joseph's college of Arts & Science (Autonomous), Cuddalore-1	Mobile: 9788258603 E. mail: arul_prakash@sjctnc.edu.in
2.	**Members (Internal)**	**Dr. T. Ganeshkumar** Asst. Professor, Department of Zoology, St. Joseph's college of Arts & Science (Autonomous), Cuddalore-1	Mobile: 9080466300 E. mail: ganesh@sjctnc.edu.in
3.	**Members (Internal)**	**Dr. N. Jayaprabha** Asst. Professor, Department of Zoology, St. Joseph's college of Arts & Science (Autonomous), Cuddalore-1	Mobile: 9003681552 E. mail: jayaprabha@sjctnc.edu.in
4.	**Members (Internal)**	**Dr. S. Pravina Mary** Asst. Professor, Department of Zoology, St. Joseph's college of Arts & Science (Autonomous), Cuddalore-1	Mobile: 9597329327 E. mail: pravinamary@gmail.com
5.	**Members (Internal)**	**Ms. V. Pushpa Aruvi** Guest Lecturer Department of Zoology, St. Joseph's college of Arts & Science (Autonomous), Cuddalore-1	Mobile: 8124561118 E. mail: aruvivishwanathan@gmail.com

MINUTES OF THE BOARD OF STUDIES
DEPARTMENT OF ZOOLOGY

The meeting of the Board of Studies for **Department of Zoology** was held on **26.04.2024** at **10.30 a.m.** The Chairman **Dr. P. Thenmozhi** welcomed and introduced the members.

Business brought forward/ Discussions/ Resolutions.

Various discussions were carried out regarding the syllabi and the curriculum for UG and First year PG. The following changes were made in the 5th unit of First year B.Sc., Zoology 2nd semester paper Chordata- II:

1. The topic, type study of Lemur was removed
2. The topics, Types of Apes: African apes (Chimpanzees), Asian great apes (orangutans), Asian lesser apes (Gibbon), adaptations of aquatic mammals and Conservation of Primates was added.

It was accepted to retain the remaining syllabus without any further addition, deletion and modifications.

The syllabus for I M.Sc., Zoology was kept in the board for ratification and it was accepted unanimously by the Board.

Dr. A. Arulprakash proposed the vote of thanks.

With this the meeting came to an end at 12.30 p.m.

I. UG

DEPARTMENT OF ZOOLOGY									
CURRICULUM TEMPLATE (2024-2027)									
a) B.Sc., Zoology									
SEMESTER – I									
S. No	**PART**		**HOURS/ WEEK**	**CREDITS**	**COURSE CODE**	**COURSE TITLE**	**Maximum Marks**		
							CIA	**ESE**	**TOTAL**
1	I	Language – I	4	3	21LT01/LF101/LH101S	Tamil/French/Hindi-1	25	75	100
2	II	English – I	4	3	LE101A	Communicative English-I	25	75	100
3	III	Core Theory – I	4	3	ZO101B	Invertebrata –I	25	75	100
4	III	Core Theory –II	4	3	ZO102A	Invertebrata –II	25	75	100
5	III	Core Practical-I	3	-	ZOP21A	Practical - I Invertebrata and Chordata			
6	III	Allied I (Compulsory)	5	4	ABZ101A	Allied Botany	25	75	100
7	III	Allied Practical I	3	2	ABZP11B	Allied Botany Practical	40	60	100
8	IV	SEC – I	3	2	VE101A	Value Education	25	75	100
	Total credits for Semester I		**30**	**20**			**190**	**510**	**700**
	SEMESTER – II								
S.No	**PART**		**HOURS**	**CREDITS**	**COURSE CODE**	**COURSE TITLE**	**Maximum Marks**		
							CIA	**ESE**	**TOTAL**
9	I	Language – II	4	3	21LT02//LF202/LH202S	Tamil/French/Hindi-II	25	75	100
10	II	English – II	4	3	LE202A	Communicative English-II	25	75	100
11	III	Core – III	4	3	ZO203A	Chordata-I	25	75	100
12	III	Core – IV	4	3	ZO204A	Chordata-II	25	75	100
13	III	Core Practical-I	3	4	ZOP21A	Practical – I Invertebrata and Chordata **(Contd.)**	40	60	100
14	III	Allied II (Compulsory)	4	3	21ACH201	Allied Chemistry	25	75	100

15	III	Allied Practical II	3	2	19ACP202	Allied Chemistry Practical	40	60	100
16	IV	SDC	2	2	EFE202	Effective English (Naan Mudhalvan)	25	75	100
17	IV	SEC – II	2	2	EPD201A	Dynamics of Personality	25	75	100
		Total credits for Semester II	**30**	**25**			**255**	**645**	**900**
	SEMESTER – III								
S. No.	**PART**		**HOURS**	**CREDITS**	**COURSE CODE**	**COURSE TITLE**	**Maximum Marks**		
							CIA	**ESE**	**TOTAL**
18	I	Language – III	4	3	LT303A//LF 303/LH303S	Tamil/French/Hindi-III	25	75	100
19	II	English – III	4	3	LE303A	Communicative English-III	25	75	100
20	III	Core – V	4	3	19ZO305	Cell Biology	25	75	100
21	III	Core – VI	4	3	19ZO306	Molecular Biology	25	75	100
22	III	Core Practical-II	3	-	19ZOP42	Practical – II Cell and Molecular biology, Genetics and Biotechnology			
23	III	Allied III	5	4	19ABC303	Allied Biochemistry	25	75	100
24	III	Allied Practical III	3	2	19ABP303	Allied Biochemistry Practical	40	60	100
25	IV	AEC – I	3	2	EVS301S	Environmental Science	25	75	100
		Total credits for Semester III	**30**	**20**			**190**	**510**	**700**
	SEMESTER – IV								
S.No.	**PART**		**HOURS**	**CREDITS**	**COURSE CODE**	**COURSE TITLE**	**Maximum Marks**		
							CIA	**ESE**	**TOTAL**
26	I	Language – IV	4	3	LT404A//LF 404/LH404S	Tamil/French/Hindi-IV	25	75	100
27	II	English – IV	4	3	LE404A	Communicative English-IV	25	75	100
28	III	Core – VII	4	3	19ZO407	Genetics	25	75	100
29	III	Core – VIII	4	3	19ZO408	Biotechnology	25	75	100
30	III	Core Practical – II	3	4	19ZOP42	Practical – II Cell and Molecular biology, Genetics and Biotechnology **(Contd.)**	40	60	100

31	III	Allied –IV	4	3	19AMB404	Allied Microbiology	25	75	100
32	III	Allied Practical – IV	3	2	19AMP404	Allied Microbiology Practical	40	60	100
33	III	NME	2	2	NPHEL401	**Physics for Everyday Life**	25	75	100
34	IV	SDC	2	2	ZOOF403	Office Fundamentals (Naan Mudhalvan)	25	75	100
		Total for Semester IV	**30**	**25**			**255**	**645**	**900**
	SEMESTER – V								
S.No	**PART**		**HOURS**	**CREDITS**	**COURSE CODE**	**COURSE TITLE**	**Maximum Marks**		
							CIA	**ESE**	**TOTAL**
35	III	Core – IX	5	4	20ZO509	Biostatistics and computational Biology	25	75	100
36	III	Core – X	5	4	20ZO510	Developmental Biology and Immunology	25	75	100
37	III	Core – XI	5	4	20ZO511	Animal Physiology	25	75	100
38	III	Elective – I [Compulsory]	5	4	20EZ512A	Applied Entomology	25	75	100
39	III	Elective – II [Optional]	4	3	20EZ513A	**A. Biofertilizer Technology**	25	75	100
					20EZ513B	B. Public Health and hygiene			
40	III	Core Practical – III	3	-	20ZOP63	Biostatistics, Animal Physiology, Developmental Biology and Immunology **(Contd.)**			
41	III	Core Practical – IV	3	-	20ZOP64	Environmental Biology, Economic Zoology and Evolution **(Contd.)**			
		Total credits for Semester V	**30**	**19**			**125**	**375**	**500**
	SEMESTER – VI								
S.N							**Maximum Marks**		

o	PART		HOURS	CREDITS	COURSE CODE	COURSE TITLE	CIA	ESE	TOTAL
42	III	Core – XII	5	4	20ZO614	Environmental Biology	25	75	100
43	III	Core – XIII	5	4	20ZO615	Economic Zoology	25	75	100
44	III	Core – XIV	5	4	20ZO616	Evolution	25	75	100
45	III	Elective – III [Compulsary]	4	4	20EZ617A	Aquaculture	25	75	100
46	III	Skill based subject[optional]	3	3	20EZ618A	**A Bioinstrumentation**	25	75	100
					20EZ618B	B Sericulture			
47	III	Core Practical – III	3	4	20ZOP63	Biostatistics, Animal Physiology and Developmental Biology and Immunology	40	60	100
48	III	Core Practical – IV	3	4	20ZOP64	Environmental Biology, Economic Zoology and Evolution	40	60	100
49	III	Project		2	JZO601	Project Work	50	50	100
50	IV	SDC	2	2	-	Medical Coding (Naan Mudhalvan)	25	75	100
	Total credits for Semester VI		**30**	**31**			**280**	**620**	**900**
	Total Credits		**180**	**140**					

Extra Credit Course					
S.No	**Semester**	**Part**	**Credits**	**Course Code**	**Course Title**
1.	III	IV	1	XFZO31	Field Trip/Field Visit
2.	V	IV	2	XIZO501	Internship
3.	VI	V	2	EU601	Extension Activities
4.	VI	VI	2	19SZO51	Online Learning Course (e course)-SWAYAM/NPTEL
5.	VI	VI	2	19ZOSS52	SSC-Self Study Course

II. PG

DEPARTMENT OF ZOOLOGY									
CURRICULUM TEMPLATE (2024-2027)									
b) M.Sc., Zoology									
SEMESTER – I									
S. No	**PART**		**HOURS/ WEEK**	**CREDITS**	**COURSE CODE**	**COURSE TITLE**	**Maximum Marks**		
							CIA	**ESE**	**TOTAL**
1	III	Core - I	7	5	PZO11	Structure and functions of Invertebrates	25	75	100
2	III	Core - II	7	5	PZO12	Comparative Anatomy of Vertebrates	25	75	100
3	III	Core – Practical I	6	4	PZOP11	Practical – I Invertebrates & Vertebrates	40	60	100
4	III	Elective – I	5	4	EPZO13	Molecules and their interaction relevant to Biology/ Medical Entomology	25	75	100
5	III	Elective-II	5	4	EPZO14	Biostatistics / Toxicology	25	75	100
	Total credits for Semester I		**30**	**22**			**140**	**360**	**500**
	SEMESTER – II								
S.No	**PART**		**HOURS**	**CREDITS**	**COURSE CODE**	**COURSE TITLE**	**Maximum Marks**		
							CIA	**ESE**	**TOTAL**
6	III	Core - III:	7	5	PZO21	Cellular and Molecular Biology	25	75	100
7	III	Core - IV:	7	5	PZO22	Developmental Biology	25	75	100
8	III	Core – Practical II:	6	4	PZOP22	Practical - II Cellular And Molecular Biology And Developmental Biology	40	60	100
9	III	Core - V	5	4	PZO23	Research Methodology / Basic Biotechnology	25	75	100
10	III	Elective – III	5	4	EPZO24	Economic Entomology / Biodiversity and Conservation	25	75	100
		Total credits for Semester II	**30**	**22**			**165**	**435**	**600**

Courses Offered to other Departments									
SEMESTER – III									
S.No	**Part**		**Hours/ Week**	**Credit**	**Course Code**	**Course Title**	**Maximum Marks**		
							CIA	**ESE**	**TOTAL**
1	III	Allied	5	4	19AZMB31	Classical Genetics & Biostatistics / Laboratory animal care (II Year MicroBiology)	25	75	100
2	III	Allied	3	2	19AZMP31	Classical Genetics & Biostatistics Practical / Laboratory animal care (II Year MicroBiology)	40	60	100
3	IV	AEC	3	2	EVS301S/ EVST301S	Environmental Science (All UG B.Sc/B.A/B.COM/B.C.A	25	75	100
4	IV	NME	2	2	NZOFC401	Ornamental fish culture	25	75	100
SEMESTER IV									
S.No	**Part**		**Hours/ Week**	**Credit**	**Course Code**	**Course Title**	**Maximum Marks**		
							CIA	**ESE**	**TOTAL**
4	III	Allied	5	4	19AZMB42	Applied Entomology (II Year MicroBiology)	25	75	100
5	III	Allied	3	2	19AZMP42	Applied Entomology Practical (II Year MicroBiology)	40	60	100
6	III	Allied	5	4	AZBC401T	Advanced Zoology-Theory (II Year Bio –Chemistry)	25	75	100
7	III	Allied	3	2	AZBP401	Advanced Zoology-Practical (II Year Bio –Chemistry)	25	75	100
8	IV	AEC	3	2	EVS401S	Environmental Science (All UG B.Sc/B.A/B.COM/B.C.A	25	75	100

PROGRAMME OUTCOMES (POs)

UNDER GRADUATE PROGRAMME OUTCOMES (POs)
PO1: The students find their footings in life through wholesome and integral education. **PO2:** The students are encouraged to climb the academic ladder by pursuing post graduate education in different domain. **PO3:** The students are academically and technically equipped to steer the nation along the path of progress and peace. **PO4:** The students are trained to be employable and entrepreneurial citizen of the nation. **PO5:** The students are fortified intellectually, ethically and socially to face the challenges in life.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PROGRAMME SPECIFIC OUTCOMES (PSOs)
PSO1: ***Disciplinary knowledge***
The students will develop their ability to understand the basic concepts of zoology viz., animal kingdom, systematic classification, anatomy, morphology, physiology, embryology, evolution, ecology etc.
PSO2:***Critical thinking***
The students will obtain knowledge to express their concepts effectively by understanding their subject with various disciplines.
PSO3: ***Scientific reasoning***
The students will have ability to identify, classify and describe various organisms from different phylum by understanding their structure and function of various organ system and relationship with their environment
PSO4: ***Research-related skills***
The students will develop ability to explain structure and functions of a cell and organ (from molecular level to the organ system level) as well as the process of development of an embryo
PSO5: ***Problem solving***
The students will acquire knowledge in cell biology, molecular biology, genetics, biotechnology, microbiology, biochemistry, biostatistics, developmental biology,

immunology, animal physiology, environmental biology, evolution etc., which helps to develop their ability to analyse and solve various biological problems.
PSO6: ***Cooperation/Team work***
The students will able to work effectively and respectfully with diverse team during vermiculture and mushroom culture practices
PSO7: ***Information/digital literacy***
The students will able to use various biological softwares to analyze the data by obtaining knowledge in biostatistics, computational biology and biotechnology.
PSO8: ***Self-directed learning***
The students will able to work independently to enhance their expertise through various activities like seminars, assignments, etc., and they can manage a project like vermiculture, mushroom culture, aquaculture etc., on completion of the course.
PSO9: ***Moral and ethical awareness/reasoning***
The students will have the knowledge to minimize the environmental issues like global warming, pollution, degradation of natural resources, and helps in conservation endangered species, afforestation etc.
PSO10: ***Lifelong learning***
The students will able to apply their knowledge of biological sciences in various disciplines like vermiculture, mushroom culture, aquaculture, apiculture, agriculture and medicine. And contribute the knowledge for Nations development.

SYLLABUS

I B.Sc Zoology	INVERTEBRATA-I	ZO101B
SEMESTER - I		HRS/WK – 4
CORE – I		CREDIT – 3

Objective:

1. Enlightening the knowledge classification of animals by understanding the basic concepts of biosystematics
2. To identify invertebrates and classify them up to the classes with the basis of systematic

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To describes the principles of taxonomy and classification of animal kingdom

CO2: To identify the phylum Protozoa and parasitic protozoans

CO3: To classify the phylum Porifera upto classes with examples

CO4: To understand the classification and polymorphism in Coelenterata and coral reefs

CO5: To describe the general characters and classification of phylum Platyhelminthes

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER I	COURSE CODE: ZO101B					COURSE TITLE: INVERTEBRATA-I									HOURS: 4	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	5	5	5	4	4	5	4	5	4	5	4.7
CO2	5	5	5	5	4	5	5	5	4	4	5	3	5	4	5	4.6
CO3	5	5	5	5	4	5	5	5	4	4	5	3	5	4	5	4.6
CO4	5	5	5	5	4	5	5	5	4	4	5	3	5	4	5	4.6
CO5	5	5	5	5	4	5	5	5	4	4	5	3	5	4	5	4.6
Mean Overall Score																4.6

Result: The Score of this Course is 4.6 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I **12 Hours**

PRINCIPLES OF TAXONOMY – Binomial nomenclature –rules of nomenclature – Principles of classification - classification of the animal kingdom: Linnaeus classification - R.H. Whittaker classification

UNIT – II **12 Hours**

PHYLUM PROTOZOA: General characters **Type study- paramecium:** General Morphology- Feeding mechanism, Reproduction- Binnary fission, Conjugation- Life cycle and Parasitic adaptation- parasitic protozoans [Entamoeba, Trypanosoma and plasmodium]

UNIT – III **12 Hours**

PORIFERA: General characters and classification upto classes with examples. **Type study - sycon,** Morphology, spicules and canal system in sponges, histology of sponges.

UNIT – IV **12 Hours**

COELENTERATA: General characters and classification upto classes with examples. **Type study** – **Obelia:** External characters, alternation of generation - polymorphism in coelenterates – corals and coral reefs.

UNIT – V **12 Hours**

PLATYHELMINTHES: General characters and classification upto classes with examples. **Type study**- *Taenia solium*: Morphology, Reproduction- Life cycles - Parasitic adaptations

Text Books:

1. Ekambaranatha Ayyar.M. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol.1 [Invertebrata], Viswanathan [Printers and Publishers] Pvt. Ltd.; Madras.
2. Jordan, E.L. and P.S.Verma, 1993. Inverteb=ate Zoology, 12th Edition. S.Chand and Co.Ltd., NewDelhi.

Reference Books:

1. Ekambaranatha Ayyar.M. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol.1 [Invertebrata], Viswanathan [Printers and Publishers] Pvt. Ltd.; Madras.
2. Kotpal, R.L. 1988-1992 Protozoa, Porifera, Coelenterata, Helminthes, Annelida, Arthropoda,Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. Parker and Haswell, 1964 Test Book of Zoology. Vol.1 [Invertebrata]. A.Z.T; B.S.Publishers and distributors, New Delhi.
4. L.A Borradile and F.A.Pott, 1972 The Invertebrates. Cambridge University Press. UK.
5. Adam Sedgwick. A student text book of Zoology. Vol.I and II. Central book Depot. Allahabad.
6. P.S.Dhami and J.K.Dhami. 1969 Invertebrate Zoology, S.Chand and Co. New Delhi.
7. Hyman L.H. The Invertebrate Vol.I-IV. 1955, McGraw Hill Co. New York.
8. Barrington, E.J.W.. Invertebrate structure and function. ELBS Publication.
9. Barnes. Invertebrate Zoology. Toppan International Co.

I B.Sc Zoology	INVERTEBRATA-II	ZO102A
SEMESTER - I		HRS/WK – 4
CORE – II		CREDIT – 3

Objective:

1. To study the diverse form of invertebrates
2. To acquire knowledge about causes and symptoms of some protozoan diseases
3. To study parasitic adaptations of annelids and significance of Crustacean and Echinoderm larvae

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To understand the general characters and classification of phylum Aschelminthes

CO2: To know the classification of phylum Annelida and their parasitic adaptation

CO3: To understand the phylum Arthropoda, affinities of peripatus and importance of Crustacean larvae

CO4: To understand the general characters, classification and torsion of phylum Molluca

CO5: To classify Echinodermata upto classes and to describe the significance of their larvae

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER I	COURSE CODE: ZO102A					COURSE TITLE: INVERTEBRATA-II									HOURS: 4	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	4	5	5	5	5	4	4	4	3	4	4	5	4.4
CO2	5	5	4	4	5	5	5	5	4	4	4	3	4	4	5	4.4
CO3	5	5	4	4	5	5	5	5	4	4	4	3	4	4	5	4.4
CO4	5	5	4	4	5	5	5	5	4	4	4	3	4	4	5	4.4
CO5	5	5	4	4	5	5	5	5	4	4	4	3	4	4	5	4.4
Mean Overall Score																4.4

Result: The Score of this Course is 4.4 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I

12Hours

ASCHELMINTHES – General characters and classification upto classes with examples. **Type study**: *Ascaris:* Morphology, Digestive system, Reproduction - Life cycles-Sexual Dimorphism.

UNIT – II **12Hours**

ANNELIDA: General characters and classification upto classes with examples. **Type study**: **Earthworm,** Morphology, Digestive system- metamerism in Annelids- parasitic adaptations of Leech

UNIT – III **12Hours**

ARTHROPODA: General characters and classification upto classes with examples. **Type study** – **Prawn:** Morphology, digestive system, Appendages **.** Peripatus and its affinities, Mouth parts of insects. Crustacean larvae and their importance.

UNIT – IV **12Hours**

MOLLUSCA: General characters and classification upto classes with examples. **Type study** – **Fresh water Mussel-** Morphology, digestive system**,** Economic importance of mollusca, torsion in mollusca

UNIT – V **12Hours**

ECHINODERMATA: General characters and classification upto classes with examples. **Type Study- Star fish:** Morphology (Oral and aboral surfaces)- Echinoderm larvae and their significance – water vascular system

Text Books:

1. Ekambaranatha Ayyar.M. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol.1 [Invertebrata], Viswanathan [Printers and Publishers] Pvt. Ltd.; Madras.
2. Jordan, E.L. and P.S.Verma, 1993. Invertebrate Zoology, 12th Edition. S.Chand and Co.Ltd., NewDelhi.
3. Kotpal, R.L. 1988-1992 Protozoa, Porifera, Coelenterata, Helminthes, Annelida, Arthropoda,Mollusca, Echinodermata. Rastogi Publications, Meerut.

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1. Parker and Haswell, 1964 Test Book of Zoology. Vol.1 [Invertebrata]. A.Z.T; B.S.Publishers and distributors, New Delhi.
2. L.A Borradile and F.A.Pott, 1972 The Invertebrates. Cambridge University Press. UK.
3. Adam Sedgwick. A student text book of Zoology. Vol.I and II. Central book Depot. Allahabad.
4. P.S.Dhami and J.K.Dhami. 1969 Invertebrate Zoology, S.Chand and Co. New Delhi.
5. Hyman L.H. The Invertebrate Vol.I-IV. 1955, McGraw Hill Co. New York.
6. Barrington, E.J.W.. Invertebrate structure and function. ELBS Publication.
7. Barnes. Invertebrate Zoology. Toppan International Co.

I B.Sc Zoology	ALLIED BOTANY	ABZ101A
SEMESTER – I		HRS/WK – 5
ALLIED BOTANY		CREDIT – 3

Objective:

To teach of basic idea of plant science through traditional disciplines such as plant taxonomy, anatomy, morphology, physiology, embryology, genetics, evolution and ecology.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To understand the taxonomy of plants

CO2: To describe the structure and components of prokaryotic and eukaryotic plant cells.

CO3: To understand plant physiology and embryology

CO4: To describe the structure and life history of the plant species included in the syllabus

CO5: To acquire knowledge on plant genetics, evolution and ecology

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER I	COURSE CODE: ABZ101A					COURSE TITLE: ALLIED BOTANY								HOURS: 5	CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	5	4	4	2	3	5	1	5	1	5	4.0
CO2	5	5	5	5	4	5	4	3	4	4	5	1	5	1	5	4.1
CO3	5	5	4	5	4	5	4	3	3	4	5	1	5	2	5	4.0
CO4	5	5	4	5	4	5	4	3	3	3	5	1	5	3	5	4.0
CO5	5	5	4	5	4	5	4	3	2	4	5	2	5	3	5	4.1
Mean Overall Score																4.0

Result: The Score of this Course is 4.0 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT –I: TAXONOMY, BACTERIA AND VIRUS **15 Hours**

General outline of Bentham and Hooker's system of classification. Study of the characters and the economic important of the following families Cucurbitaceae, Apocynaceae, Euphorbiaceae and Liliaceae. Bacteria-general characters-shape-flagellation-structure of E.coli –reproduction and economic importance.Structure of TMV and Bacteriophage.

UNIT –II: CELL BIOLOGY AND ANATOMY **15 Hours**

Prokaryotic and eukaryotic cell- ultrastructure of plant cells-cell organelles –Chloroplast, Mitochondria and Nucleus, Cell divisions- Mitosis and Meiosis. Tissues- meristematic and permanent tissues, primary and normal secondary thickening of the dicot stem.

UNIT –III: PLANT PHYSIOLOGY AND EMBRYOLOGY **15 Hours**

Photosynthesis –light reaction- calvin cycle, respiration- glycolysis and kreb's cycle-electron transport system- Growth hormones-Auxin, Gibberillin and Cytokinin-tissue culture – principles. Structure of mature anther-structure of mature ovule-and its types and fertilization.

UNIT – IV: STRUCTURE AND LIFE HISTORY **15 Hours**

Algae-Chlorella; Fungi- Penicillium, Agaricus; Bryophytes- Funaria; Pteridophytes-Lycopodium (excluding developmental studies) and Gymnosperms-Cycas. Economic importance of chlorella, penicillium and Agaricus.

UNIT- V: GENETICS, EVOLUTION AND ECOLOGY **15 Hours**

Mendelism-monohybrid and dihybrid crosses and their corresponding back and test crosses; Theories of evolution-Lamarckism and Darwinism; Ecosystem- fresh water ecosystem, environmental pollution-types and control measures.

Text Books

1. Ashok Bendre, A.K. and Pandey P.C. (1975) Introductory Botany. Rastogi Publication Meerut.

2. Ganguly, A.K. and Kumar. N.C. (1971) General Botany Vol. I & Vol. II, Emkay Publication, Delhi.

Reference Books

1. Rev. Fr. Ignacimuthu, S.J. (1975) Basic Biotechnology – Tata Mcraw till publication co., New Delhi.

2. Rao,K.N.Krishnamoorthy,K.V. and Rao. G.(1975) Ancillary Botany. S. ViswanathanPrivate.Ltd.,Chennai

I B.Sc Zoology	ALLIED BOTANY PRACTICAL	ABZP11B
SEMESTER –I		HRS/WK – 3
ALLIED PRACTICAL –I		CREDIT – 2

1. Description of plants in technical terms belonging to the families mentioned in the theory part.

2. To study the Anatomy of Pteridophyte and Gymnosperm materials of the syllabus.

3. Identification, Micropreparation and Description of the Anatomical materials given in the syllabus.

4. Description of the experimental setup of plant physiology.

I B.Sc Zoology	CHORDATA-I	ZO203A
SEMESTER - II		HRS/WK – 4
CORE – III		CREDIT – 3

Objective:

To acquire knowledge on classification of chordates and their characteristic features

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To describes the general characters and affinities of Cephalochordata

CO2: To know the general characters and affinities of Hemichordata

CO3: To understand the general characters and affinities of Urochordata

CO4: To describes the salient features and classification of Phylum chordata and their origin

CO5: To know classification of phylum Pisces, Accessory respiratory organs and Migration in fishes

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER II	COURSE CODE: ZO203A					COURSE TITLE: CHORDATA-I								HOURS: 4	CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	4	4	5	5	5	3	4	4	4	5	4	4	4.3
CO2	5	5	4	4	4	5	5	5	4	4	4	3	5	4	4	4.3
CO3	5	5	4	4	4	5	5	5	4	4	4	3	5	4	4	4.3
CO4	5	5	3	4	4	5	5	5	4	4	4	3	5	4	4	4.3
CO5	5	5	3	4	4	5	5	5	4	4	4	3	5	4	4	4.3
Mean Overall Score																4.3

Result: The Score of this Course is 4.3 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I **12 Hours**

Sub phylum: Prochordata: General Characters -**Type study**: **Amphioxus** (Cephalochordata) – Morphology, Wheel organ, feeding mechanism- Affinities with invertebrates and chordates

UNIT –II **12 Hours**

Sub phylum: Prochordata: **Type study**: **Balanoglossus** (Hemichordata) General Characters and Chordate features - Affinities with Urochordata, Amphioxus, Prochordata

UNIT – III **12 Hours**

Sub phylum: Prochordata: **Type study**: **Ascidian:** General Characters – Morphology and affinities with Urochordata and cephalochordata – Ascidian Tadpole larva – retrogressive metamorphosis.

UNIT – IV **12 Hours**

Salient Features and General classification of Phylum chordate upto orders. Origin of Chordates – theories proposed about chordata –Coelenterate theory, nemertean theory, annelid theory, insect theory and echinoderm theory.

UNIT – V **12 Hours**

Class PISCES General characters and classification upto orders. **Type study: Shark.** Morphology- digestive system, respiratory system, reproductive system -Accessory respiratory organs in fishes, Migration in fishes.

Text Books:

1. EkambaranathaAyyar, M and T.N Anantha Krishnan 1992, A manual of zoology Vol. II [Chordata]. S. Viswanathan [Printers and publishers] Pvt. Ltd., Madras.
2. Jordan E. L. and P.S. Verma 1995. Chordate Zoology and elements of Animal Physiology. S. Chand and co., New Delhi.
3. Kotpal R.L. 1992. Vertebrata, Rastogi publication, Meerut.

Reference Books:

1. Nigam. H.C 1983 Zoology of chordates, Vishal publications, Jalandhar.
2. Waterman, Allyn J.et al. 1971, Chordate Structure and functions, Mac. Millan and co., New York.
3. Jollie. M. 1968. Chordate Morphology. East west press Pvt. Ltd., New Delhi.
4. Hyman. L.H. Comparative vertebrate zoology. McGraw Hill co. New York

I B.Sc Zoology	CHORDATA-II	ZO204A
SEMESTER – II		HRS/WK – 4
CORE – IV		CREDIT – 3

Objective:

To impart peculiar characteristics of prochordates, amphibians, snakes, birds and mammals.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To classify phylum Amphibia and explain their adaptive features and parental care

CO2: To classify the phylum Reptilia and biting mechanism of poisonous snakes

CO3: To describe the phylum Aves and migration and flight adaptation in birds

CO4: To understand the Phylum Mammalia and egg laying mammals

CO5: To understand the Origin of Primates and adaptations of aquatic mammals

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER II	COURSE CODE: ZO204A					COURSE TITLE: CHORDATA-II								HOURS: 4	CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	5	5	5	3	4	4	3	5	4	5	4.5
CO2	5	5	4	5	4	5	5	5	3	4	4	3	5	4	5	4.4
CO3	4	5	4	5	4	5	5	5	3	4	4	3	5	5	5	4.4
CO4	4	5	4	5	4	5	3	3	4	4	4	3	5	4	5	4.1
CO5	4	5	4	5	4	5	3	3	4	4	4	3	5	3	5	4.1
Mean Overall Score																4.3

Result: The Score of this Course is 4.3 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I **12Hours**

CLASS AMPHIBIA General characters and classification upto orders. **Type study** :**Frog** – morphology, digestive system, respiratory system, urinogenital system, sexual dimorphism, life cycle - Adaptive features of Anura, Urodela&Apoda. Parental care in Amphibia – Neoteny.

UNIT –II **12Hours**

CLASS REPTILIA- General characters and classification upto orders.**Type study** – **Calotes:** morphology, digestive system, respiratory system, urinogenital system -Poison apparatus and biting mechanism of poisonous snakes. Conservation of turtles and crocodiles.

UNIT – III **12Hours**

CLASS AVES - General characters and classification upto orders. Features of Archaeopteryx **Type study** –**Pigeon:** morphology, digestive system, respiratory system, urinogenital system**.**Migration in birds, Flight adaptation.

UNIT – IV **12Hours**

CLASS MAMMALIA - General characters and classification upto orders. Egg laying mammals. **Type study** – **Rabbit:** morphology, digestive system, respiratory system, urinogenital system**.** Dentition in mammals.

UNIT – V **12Hours**

PRIMATES- General characters and classification **- Origin of Primates –**Types of Apes: African apes (Chimpanzees), Asian great apes (orangutans), Asian lesser apes (Gibbon) adaptations of aquatic mammals, Conservation of Primates.

Text Books:

1. EkambaranathaAyyar, M and T.N Anantha Krishnan 1992, A manual of zoology Vol. II [Chordata]. S. Viswanathan [Printers and publishers] Pvt. Ltd., Madras.
2. Jordan E. L. and P.S. Verma 1995. Chordate Zoology and elements of Animal Physiology. S. Chand and co., New Delhi.
3. Kotpal R.L. 1992. Vertebrata, Rastogi publication, Meerut.

Reference Books:

1. Nigam. H.C 1983 Zoology of chordates, Vishal publications, Jalandhar.
2. Waterman, Allyn J.et al. 1971, Chordate Structure and functions, Mac. Millan and co., New York.
3. Jollie. M. 1968. Chordate Morphology. East west press Pvt. Ltd., New Delhi.
4. Hyman. L.H. Comparative vertebrate zoology. McGraw Hill co. New York

I B.Sc Zoology	CORE PRACTICAL – I INVERTEBRATA AND CHORDATA	ZOP21A
SEMESTER – I & II		HRS/WK – 3
CORE PRACTICAL – I		CREDIT – 4

DISSECTIONS
Earthworm –Digestive system
Cockroach – Digestive, Nervous system and Reproductive system, **Prawn** – Nervous system, **Fish** – Digestive system

MINOR PARCTICAL
MOUNTING **-Insect Mouth parts :** Cockroach, Honey bee, House Fly and Mosquito **Prawn** – Appendages, **Shark -** Placoid scales, **Earthworm** – Body setae

SPOTTERS
Study of the following specimens

1. Classify by giving reasons
Paramecium,Sycon, Obelia, *Taenia solium*, Neries, Prawn, Freshwater mussel, Seastar, Amphioxus, Shark, Hyla, Rhacophorus, Calotes, Pigeon, Rat/Rabbit.

2. Adaptations to their respective modes of life
Entamoeba, Trypanosoma, Plasmodium, Corals [any 2], Ascaris, Fasiola, *Wuchereria bancrofti*, Cheatopterus, Leech, Limulus, Nauplius, Mysis, Zoea, Balanoglossus, Ascidian, Ichthyophis, Draco, sea snake and Bat.

3. Biological significance:
Paramecium conjugation and binary fission, physalia, Trochophore Larva, Peripatus, Sacculina On Crab, Sea Anemone on Hermit Crab, Pearl Oyster, Bipinnaria Larva, Anabas, Hippocampus, Narcine, Echeneis, Arius, Exocoetus, Eel, Amblystoma, Axolotl Larva, Bufo, Cobra, Krait, Russels Viper, EchisCarinata, Turtle, Parrot, Woodpecker, King Fisher and Ant eater

4. Relate structure and function:
Sponge Spicules, Obelia-Polyp, Taenia-Scolex, Nereis - Parapodium, Book lungs of scorpion/Honey bee sting apparatus, Pedicellaria of Sea star, Ctenoid Scale and Quill Feather of pigeon.

5.Draw labeled sketches:
T.S. of Nereis, T.S. of Leech, Obelia medusa, T.S. of Amphioxus through Pharynx, T.S. through arm of Sea star.

6.Osteology
Skeleton - Pectoral girdles of Frog and Pigeon.,Pelvic Girdles of Frog and Pigeon.

Fore and Hind limbs of Frog and Pigeon.,Synsacrum of Pigeon. **Dentition -** Dog, Rabbit and Man.

Reference Books:

1. Verma. P.S. 2011 A Manual of Practical Zoology INVERTEBRATES Chand & Co, Ltd, Ram Nagar -New Delhi.
2. Verma. P.S. 2011 A Manual of Practical Zoology CHORDATES, Chand & co, Ltd. Ram Nagar – New Delhi.
3. JayanpaSinha . 2010 Advanced Practical Zoology, Books & Allied (p) Ltd. No.1. Subham Plaza IFloor, Calcutta.

I B.Sc Zoology	EFFECTIVE ENGLISH	EFE202
SEMESTER – II		HRS/WK - 2
PART – IV SDC		CREDIT- 2

Objectives:

1. To develop the communication ability of the students with focus on 'Speaking Skill' enabling them to use the language more effectively and confidently

2. To widen the student's grasp of vocabulary and enable them to use these words in appropriate contexts.

Course Outcomes (CO's):

At the end of the course students exhibit

CO1: Ability to start a conversation, interrogate, apologise or request appropriately in various context.

CO2: Ability to read and interpret, converse over telephone.

CO3: Display use of rich vocabulary and coin words.

CO4: Develop oratorical skills

CO5: Decode the patterns of language behavior to describe, narrate or summarise a paragraph.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER II	COURSE CODE: EFE202					COURSE TITLE: EFFECTIVE ENGLISH									HOURS: 2	CREDITS:2
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	4	5	3	3	5	5	2	5	2	4	4.1
CO2	5	5	5	5	4	4	5	3	3	5	5	3	5	2	4	4.2
CO3	5	5	5	4	4	4	5	3	3	5	5	2	5	2	4	4.1
CO4	4	5	4	4	4	4	5	3	3	5	5	2	5	2	4	4.0
CO5	5	5	4	5	4	4	5	3	3	5	5	3	5	2	4	4.1
Mean Overall Score																4.1

Result: The Score of this Course is 4.1 (Very High)

This Course is having **VERY HIGH association** with Programme Outcome and Programme Specific Outcome

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

Session 1 Breaking the Ice
• Greeting People
• Discussing Current Events
• Talking about different situations

Session 2 Background
• Talking about events in life
• Discussing past events
• Talking about your education

Session 3 Achievement
• Talking about experiences •
Discussing progress toward goals
• Talking about competition

Session 4 News
• Discussing news stories
• Discussing recent events
• Talking about memories

Session 5 Virtual World
• Discussing purposes and reasons
• Understanding common technology terms
• Writing emails

Session 6 On the Move
• Discussing travel procedures
• Talking about frequency
• Talking about travel problems

Session 7 Planning
• Making arrangements
• Describing arrangements
• Discussing plans and decisions

Session 8 Predictions
• Discussing predictions
• Describing the climate
• Discussing forecasts and scenarios

Session 9 Buying and Selling
• Talking about purchasing
• Discussing advantages and disadvantages
• Making comparisons

Session 10 Leisure Time
• Talking about leisure
• Discussing likes and dislikes
• Discussing feelings about experiences

Session 11 Lifestyle
• Talking about time
• Giving advice
• Discussing imaginary scenarios

Session 12 Forces of Nature
• Discussing the natural environment
• Describing systems
• Describing position and movement

Session 13 On the Road
• Talking about cars and roads
• Explaining rules
• Discussing rental arrangements

Session 14 Fashion Sense
• Describing things relatively
• Describing clothing
• Discussing safety issues

Session 15 In Control
• Talking about electrical devices
• Understanding technical instructions
• Describing controlling actions

Text books
http://kb.naanmudhalvan.in/images/c/c7/Cambridge_Course_Details.pdf

References
http://kb.naanmudhalvan.in/images/c/c7/Cambridge_Course_Details.pdf

II B.Sc Zoology	CELL BIOLOGY	19ZO305
SEMESTER – III		HRS/WK – 4
CORE – V		CREDIT – 3

Objective:

1. Have an enhanced knowledge on microscopes, cytological techniques.
2. To provide a basic information on structure and functions of cell and cell organelles

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To understand the Principles of microscopes and Cytological techniques

CO2: To describe the Cell theory, Ultra structure of animal cell

CO3: To recognize the properties of cytoplasm and Ultra structure of nucleus.

CO4: To explain the structure and functions cell organelles

CO5: To obtain knowledge on cell cycle and cell division

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER III	COURSE CODE: 19ZO305					COURSE TITLE: CELL BIOLOGY								HOURS: 4	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	5	5	5	5	5	5	5	5	2	5	4.7
CO2	5	5	5	5	4	5	5	4	5	5	5	4	5	2	5	4.6
CO3	5	5	5	5	4	5	5	5	5	5	5	4	5	2	5	4.7
CO4	5	5	4	5	4	5	5	4	5	5	5	3	5	2	5	4.5
CO5	5	5	5	5	4	5	5	4	5	5	5	4	5	2	5	4.6
Mean Overall Score																4.6

Result: The Score of this Course is 4.6 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I **12 Hours**

HISTORY OF CELL– Principles of microscopes: light and electron, **Cytological techniques** - cell fractionation, Homogenization, Centrifugation, Isolation of Sub-cellular components – Fixation- Sectioning-Staining

UNIT – II **12 Hours**

CELL – Cell theory, Ultra structure of animal cell – structure, composition and functions – cell components – Plasma Membrane-permeability, fluid mosaic theory, bilayer model, sandwich model – Endoplasmic reticulum- rough and smooth endoplasmic reticulum.

UNIT – III **12 Hours**

CYTOPLASM – Physical, chemical and biological properties. **Nucleus** – Ultrastructure, Composition and Function – nucleolus: structure, types and functions.

UNIT – IV **12 Hours**

RIBOSOMES- structure and function, Golgi Complex- structure and function, Lysomes: structure and function -suicidal bag, Glyoxisomes, peroxisomes, centrioles: structure and function and Mitochondria- structure and function, cell respiration.

UNIT – V **12 Hours**

CELL CYCLE AND CELL DIVISION – Amitosis, Mitosis- Prophase, metaphase, anaphase, telophase- and meiosis Prophase-leptotene, zygotene, pachytene, diplotene and diakinesis- metaphase, anaphase, telophase and their significance.

Text Books:

1. Powar, C.B.,1989.Essentials of Cytology, Himalaya Publishing House, Bombay.
2. Verma, P.S., and V.K. Agarwal, 1995. Cell and Molecular Biology, 8th Edition, S. Chand & Co., NewDelhi.
3. Rastogi. S.C. 2008 Cell and Molecular Biology, 2nd Edition, New Age International (p) Ltd., New Delhi

Reference Books:

1. Cohn, N.S., 1979, Elements of Cytology, Freeman Book co., New Delhi.
2. De Robertis, E.D.P. and E.M.F. De Robertis, 1988. Cell and molecular Biology, 8th Edition, International edition Informes Hongkong. 734p.
3. Gies, A.C., 1979. Cell Physiology, Saunders co., Philadelphia, London, Toronto.
4. Jayanthi .G.P. 2009 Molecular Biology, M.J.P Publ. Chennai.

II B.Sc Zoology	MOLECULAR BIOLOGY	19ZO306
SEMESTER – III		HRS/WK – 4
CORE – VI		CREDIT – 3

Objective:

Expose the students to the incipient field of research in molecular biology by providing basic knowledge on biochemical and cell culture techniques and cancer biology

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To get knowledge on biochemical and cell culture techniques

CO2: To know chromosomes structure and giant chromosomes.

CO3: To understand the structure and function of DNA and types of RNA.

CO4: To realize cancer biology and process of aging

CO5: To describe the mechanism of DNA replication and Protein synthesis

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER III	COURSE CODE: 19ZO306					COURSE TITLE: MOLECULAR BIOLOGY										HOURS: 4	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10		
CO1	5	5	5	5	4	4	5	3	5	5	4	4	5	2	5	4.4	
CO2	5	5	5	4	4	4	5	3	5	5	4	3	5	2	5	4.3	
CO3	5	5	4	3	4	4	5	3	5	5	4	2	5	2	5	4.1	
CO4	5	5	5	4	4	4	5	3	4	5	4	2	5	2	5	4.1	
CO5	5	5	5	4	4	4	5	3	5	5	4	4	5	2	5	4.3	
Mean Overall Score																4.2	

Result: The Score of this Course is 4.2 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I **12Hours**

BIOCHEMICAL TECHNIQUES – Electrophoresis – types of electrophoresis: Paper Electrophoresis, Agarose gel electrophoresis, PAGE, SDS-PAGE, PFGE, 2D electrophoresis - applications of Electrophoresis. **Cell culture techniques and applications**.

UNIT – II **12Hours**

CHROMOSOMES: structure and function, Types of chromosome – Heterochromatin: structure, types and function, Euchromatin: structure and function - **Giant chromosomes:** Polytene and Lamp brush chromosomes.

UNIT – III **12Hours**

dna: Structure - Watson and Crick Model of DNA – Chemical composition and functions **of** DNA. **RNA:** Types - Structure and functions of Messenger RNA, Structure and functions of Transfer RNA, Structure and functions of Ribosomal RNA.

UNIT – IV **12Hours**

CANCER BIOLOGY – structure of cancer cell, characteristics of cancer, properties of cancer cells, types of cancer, causes of cancer, carcinogenesis. **Aging** – theories of aging, Cell death- Necrosis and Apoptosis.

UNIT – V **12Hours**

DNA REPLICATION – Types, Enzymology and Mechanism, Semi conservative replication. **Protein synthesis:** Mechanism-Transcription-Translation-Post translation.

Text Books:

1. Verma, P.S., and V.K. Agarwal, 1995. Cell and Molecular Biology, 8th Edition, S. Chand & Co., NewDelhi.
2. Rastogi. S.C. 2008 Cell and Molecular Biology, 2nd Edition, New Age International (p) Ltd., New Delhi.

Reference Books:

1. Cohn, N.S., 1979, Elements of Cytology, Freeman Book co., New Delhi.
2. De Robertis, E.D.P. and E.M.F. De Robertis, 1988. Cell and molecular Biology, 8th Edition, International edition Informes Hongkong. 734p.
3. Gies, A.C., 1979. Cell Physiology, Saunders co., Philadelphia, London, Toronto.
4. Jayanthi .G.P. 2009 Molecular Biology, M.J.P Publ. Chennai.

II B.Sc Zoology	GENETICS	19ZO407
SEMESTER – IV		HRS/WK – 4
CORE – VII		CREDIT – 3

Objective:

To provide basic knowledge in the field of genetics and applications of modern genetics.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To acquire basic information on genetics and Mendelian laws

CO2: To understand multiple alleles and pedigree analysis in human traits.

CO3: To define linkage and crossing over.

CO4: To describe non-disjunction and gynandromorphs and fine structure of gene

CO5: To acquire knowledge on mutation, applied genetics and population genetics

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER IV	COURSE CODE: 19ZO407					COURSE TITLE: GENETICS								HOURS: 4	CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	4	5	3	3	5	5	2	5	2	4	4.1
CO2	5	5	5	5	4	4	5	3	3	5	5	3	5	2	4	4.2
CO3	5	5	5	4	4	4	5	3	3	5	5	2	5	2	4	4.1
CO4	4	5	4	4	4	4	5	3	3	5	5	2	5	2	4	4.0
CO5	5	5	4	5	4	4	5	3	3	5	5	3	5	2	4	4.1
Mean Overall Score																4.1

Result: The Score of this Course is 4.1 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I **12Hours**

Introduction to genetics – Basis of Mendelian Inheritance and Mendelian Laws – mendel's experiment-monohybrid and dihybrid cross- Interaction of Genes – Complementary Factors, Inhibitory and lethal Factors -Atavism.

UNIT-II **12Hours**

Multiple Alleles – Blood Groups and their Inheritance in man- ABO Blood group inheritance, Rh factor. **Pedigree analysis** in human traits- uses of pedigree analysis.

UNIT – III **12Hours**

Linkage-definition, types, linkage in Drosophila and **crossing over** -definition, types of crossing over Drosophila – Morgan's Experiments - Cytological Evidence for Crossing Over.**Sex determination and sex linkage** in Drosophila and Man.

UNIT – IV **12Hours**

Non – Disjunction and Gynandromorphs– Cytoplasmic Inheritance Maternal effect on Limnaea [shell coiling], **Fine Structure of Gene** – Cistron –Recon, Muton – **Gene Regulation** – Operon concept – Lac Operon.

UNIT – V **12Hours**

Mutation – chromosomal Aberrations – examples from Human.**Applied Genetics** – Animal Breeding – Heterosis, Inbreeding, Out breeding, Out Crossing, Hybrid Vigour. **Population Genetics:** Hardy Weinberg Law – factors affecting Hardy Weinberg Law.

Text Books:

1. Verma, P.S. and V.K. Agarwal, 1995 Genectis, 8th edition, S. Chand & Co, New Delhi.
2. Veer BalaBastogi, 2019 Genetics, Medtech Publishers

Reference Books:

1. Gunther S. Stent 1986. Molecular Genetics. Macmillan Publishing Co Inc.
2. Gardener. 1991. Principles of Genetics. 8th edition. John wiley& sons Inc. New York. Chichester,Brisbane, Toronto, Singapore.
3. Monroe. W. Strick Berger 2004 Genetics. Printice Hall of India New Delhi.
4. Nicholls. 2002 Genetic Engineering, Cambridge University Press. UK.

II B.Sc Zoology	BIOTECHNOLOGY	19ZO408
SEMESTER – IV		HRS/WK – 4
CORE – VIII		CREDIT – 3

Objective:

1. To generate potential knowledge regarding the scope and applications of biotechnology.
2. To understand the modern biotechnology practices and approaches with highlighting in genetic engineering , rDNA technology, cloning and gene transfer technology

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To know the scope and applications of biotechnology

CO2: To acquire knowledge on techniques of genetic engineering and rDNA technology.

CO3: To realise gene cloning in prokaryotes and basics of human genome project.

CO4: To describe transgenic plants and animals

CO5: To understand the application of recombinant DNA technology

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER IV	COURSE CODE: 19ZO408					COURSE TITLE: BIOTECHNOLOGY								HOURS: 4	CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	3	5	1	3	4	4	3	4	3	5	4.0
CO2	5	5	5	5	4	3	5	2	3	4	4	4	4	4	5	4.1
CO3	5	5	4	5	4	3	5	2	4	4	4	4	4	4	5	4.1
CO4	5	5	5	5	4	3	5	2	4	4	4	4	4	4	5	4.2
CO5	5	5	5	5	4	3	5	2	4	4	4	4	4	3	5	4.1
Mean Overall Score																4.1

Result: The Score of this Course is 4.1 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I **12Hours**

Definition – Scope and applications of Biotechnology – isolation of DNA – types of DNA extraction methods – cloning – Tools of Genetic Engineering: Enzymes, Linkers and Adaptors.

UNIT-II **12Hours**

Cloning vectors: requirements of a cloning vector, types [plasmids, pBr322, Phage I, Cosmids and phagemids].Techniques of Genetic Engineering - recombinant DNA Technology.

UNIT-III **12Hours**

Gene Cloning in prokaryotes, **cDNA- Genomic Library,** construction and uses**.**Human genome project: Genome and its significance, techniques of Human Genome Project, Potential benefits of Human genome projects .

UNIT – IV **12Hours**

Transgeneic plants and animals – Production of Transgenic plant (Bt. Cotton) and transgenic animal (mice), Applications of Transgenic animals. .DNA finger printing and its applications– gene therapy – biosensors and its applications – biochips and its applications

UNIT-V **12Hours**

Application of Recombinant DNA technology in Medicine and Agriculture – Application of biotechnology in environmental protection – Socio economic issues of Biotechnology in India

Text Books:

1. Dubey,R.C 2006 Text Book of Biotechnology S. Chand & co. New Delhi.
2. Kumar H. D.1998 A text book of Biotechnology, affiliated East West pvt. Ltd., New Delhi.

Reference Books:

1. Higgins II, Best GJ and Jones J 1996 Biotechnology – Principles and application Black well scientific Publication Oxford London.
2. Gupta, P.K. 2001 Elements of Biotechnology Rastogi publication, Meerut.
3. Vijayaraman, Chellammal K.S and Manikkili. P 1998. UyiriyaeThozhilnutpam. Chimeeraa, Trichy.

II B.Sc Zoology	CORE PRACTICAL – II CELL AND MOLECULAR BIOLOGY, GENETICS AND BIOTECHNOLOGY	19ZOP42
SEMESTER – III & IV		HRS/WK – 3
CORE PRACTICAL – II		CREDIT – 4

CELL AND MOLECULAR BIOLOGY

Cytometry

Compound microscope, Camera Lucida, Stage and Ocular Micrometers

Blood Smear Preparation – Differential count of W.B.C.

Total count of RBC using Haemocytometer.

Total count of WBC using Haemocytometer.

Slide Preparation

Buccal Smear.

Mitosis in onion root tip squash.

Squash preparation of Grass hopper testes.

Study of prepared slides of histology.

Columnar Epithelium, Ciliated epithelium, Glandular Epithelium.Cartilage T.S., Bone T.S., Cardiac Muscle, Striated muscle, Non Striated muscle, Neuron, C.S of mammalian Testis and Ovary.

GENETICS

Squash preparation of Salivary glands of chironomous larva (Giant chromosome).

Male & Female identification of Drosophila.

Observation of common Mutants of Drosophila.

Human Blood Grouping.

BIOTECHNOLOGY

Study of prepared slides, Models or specimen.

Escherichia coli, Bacteriophage, Plasmid.

Demonstration of P.C.R technique: Southern blot, Electrophoresis.

Visit to Biotechnology lab and Report – compulsory.

II B.Sc Zoology	OFFICE FUNDAMENTALS	ZOOF403
SEMESTER – IV		HRS/WK-2
SDC		CREDIT – 2

Objective:
To know the fundamentals of MS-Word, MS-Excel and MS-PowerPoint.

Course Outcomes:
CO1: To Understand the Basic concepts of MS-Office Packages – MS-Word.
CO2: Ability to format text, and paragraphs in MS-Word..
CO3: To Understand the basic usage of MS-Office Packages – MS-Excel
CO4: Ability to format cells using spreadsheet.
CO5: To Understand the basic usage of MS-Office Packages – MS-PowerPoint

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER IV	COURSE CODE: ZOOF403					COURSE TITLE: OFFICE FUNDAMENTALS									HOURS: 2	CREDITS :2
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO2	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO3	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO4	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO5	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
Mean Overall Score																4.5

Result: The Score of this Course is 4.5 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

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UNIT- I: **6Hours**

Introduction to Word: Introduction to Word Processing, Advantages of word processing, Creating, Saving, Editing and Printing a document: Selecting, Deleting, Replacing Text, Copying text to another file.

UNIT- II: **6Hours**

Formatting Text and Paragraph: Using the Font Dialog Box, Paragraph Formatting using Bullets and Numbering in Paragraphs, Checking Spelling, Line spacing, Margins, Space before and after paragraph.

UNIT- III: **6Hours**

Introduction to Excel: Introduction to spreadsheet, creating, editing, saving, and printing spreadsheets, entering information: Numbers, Formula, Editing Data in a cell, Filtering Data, using a Range with SUM, Excel functions, Modifying worksheets with color & auto formats.

UNIT- IV: **6Hours**

Formatting cells: Moving and copying data, Inserting and Deleting Row and columns in the worksheet, Using the format cells Dialog box, using chart wizard to create a chart, Securing & Protecting spreadsheets.

UNIT- V: **6 Hours**

Introduction to Power Point: Introduction of slide presentation- PresentationsCreating, Manipulating & Enhancing Slides-Organizational Charts- Inserting clip Arts, Adding Objects- formatting and checking text.

TEXT BOOKS:

1. Computer Basics with Office Automation, by Dr. Archana Kumar,Product information Publisher Dreamtech Press (1 January 2019)
2. Computer Fundamentals and Office Automation, by Dr.R. Deepalakshmi, Charulatha Publications Private Limited (1 January 2019)
3. Microsoft Office 2007 Bible. , John Walkenbach, Herb Tyson, Cary N.Pr, FaitheWempen, John Wiley & Sons publications, 2007.

REFERENCE BOOKS:

1. “Microsoft Office 2007,Will Train, Gini Corter, Annette Marquis” BPB publications,2007
2. “PC Software for Windows 98, Made Simple R. K. TAXALI ” TMH publications, 2001
3. ”MS Office 2000 for every one”,Sanjay Saxena, Vikas Publishing House PVT LTD,2000.
4. Office Automation, by Girija D. K. -Rashmi M. -Shilpa H.K. , Himalaya Publishing House Pvt Ltd, 2022
5. "Computer Basics with Office Automation", by Archana Kumar,I K International Publishing House Pvt. Ltd ,30 December 2013

III B.Sc Zoology	BIOSTATISTICS AND COMPUTATIONAL BIOLOGY	20ZO509
SEMESTER – V		HRS/WK - 5
CORE – IX		CREDIT - 4

Objective:

1. To learn basics of Biostatistics and their application in biology
2. To acquire knowledge on Computational Biology

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To acquire knowledge on scope and sampling methods in biostatistics

CO2: To understand the measure of central tendency and measures of dispersion.

CO3: To understand types of computers, operating systems and its applications

CO4: To acquire knowledge on biological databases like NCBI, GenBank etc.

CO5: To gain knowledge on DNA and RNA sequencing

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER V	COURSE CODE: 20ZO509					COURSE TITLE: BIOSTATISTICS AND COMPUTATIONAL BIOLOGY									HOURS: 5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	5	4	5	5	4	5	5	4	1	5	2	5	4.3
CO2	5	5	4	5	4	5	5	3	5	5	4	1	5	2	5	4.2
CO3	5	5	4	5	4	4	5	2	5	5	4	2	5	4	5	4.3
CO4	5	5	4	5	4	5	5	3	4	5	4	1	5	2	5	4.1
CO5	5	5	4	5	4	4	5	3	4	5	4	1	5	1	5	4.0
Mean Overall Score																4.2

Result: The Score of this Course is 4.2 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

BIOSTATISTICS

UNIT – I **15 Hours**

Definition and Scope, Census and sampling methods – collection and presentation of data. Diagrams and graphs; bar, pie, Histogram, Line graph – concept of Statistical population and sample characteristics of frequency distribution.

UNIT – II **15 Hours**

Measures of central tendency: mean, median and mode. Measures of Dispersion, Range, Quartile deviation, mean deviation and Standard deviation. Test of significance - Student's 't'- Test.

COMPUTATIONAL BIOLOGY

UNIT – III **15 Hours**

Introduction – computer – types of modern computers – operating systems – applications of MS-WORD, MS-EXCEL and MS-PPT- Documentation and Presentation of Bio Statistical data– Browsers – search engines - Use of Internet, Messenger and E-mail – Basic Knowledge of Medical transcription.

UNIT- IV **15 Hours**

Biological databases – definition – Literature databases- NCBI – Pubmed, Medline, Protein and Nucleic acid Sequence, databases and their relationship – PIR, Swiss – Prot, GenBank, DDBJ – Structural Databases – PDB, SCOP, CATH, Structural visualization tools, RasMol, Swiss PDB viewer.

UNIT – V **15 Hours**

DNA and RNA sequencing - Pairwise sequence Alignment –Scoring Matrices - PAM and BLOSUM- statistics of alignment scored Dot Plot – local and global alignment – Database searching – FASTA and BLAST multiple sequence alignment clustal W- Phylogenetic Tress – PHYLIP.

Text Books:

1. Gupta SP 1996. Statistics –S. Chand and Co., New Delhi.
2. Christine Solomon. MS. OFFICE for Win – Microsoft office press. Developing Application with MS-OFFICE – Microsoft Office Press.

Reference Books:

1. Jerold H. Zar 1984. Bio Statistical analysis [2nd edition] printice Hall of International edition.
2. Goutham Roy 2002. Introduction to Computing and computing lab and Cad Books and allied [pvt]ltd. Kolkata.
3. Cynthia Gibbs. Developing Bioinformatics Computer Skills. Sheoff Publishers & Distributors Pvt.Ltd., Mumbai.
4. Arthur. M. Lesk 2003. Introduction to Bioinformatics, Oxford University Press, New Delhi.
5. Arthur. M. Lesk, Introdution to protein Structures Oxford University Press, New Delhi, 2000
6. Baxevanis, A and Outllette 2005. Bioinformatics a practical guide to the analysis of genes and proteins, Willy – Intersience, Hoboken, NJ. USA.

III B.Sc Zoology	DEVELOPMENTAL BIOLOGY & IMMUNOLOGY	20ZO510
SEMESTER – V		HRS/WK - 5
CORE – X		CREDIT - 4

Objective:

1. To learn basic concepts of developmental biology and artificial reproductive technology
2. To acquire knowledge on immune system and immune deficiency diseases

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To acquire knowledge on gametogenesis and parthenogenesis

CO2: To understand the process of cleavage and blastulation.

CO3: To realize embryonic adaptation and artificial reproductive technology.

CO4: To describe lymphoid organ and immune system

CO5: To gain information regarding immunoglobulin and immune deficiency diseases

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER V	COURSE CODE: 20ZO510					COURSE TITLE: DEVELOPMENTAL BIOLOGY & IMMUNOLOGY								HOURS: 5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	5	4	5	5	4	5	5	4	1	5	2	5	4.3
CO2	5	5	4	5	4	5	5	3	5	5	4	1	5	2	5	4.2
CO3	5	5	4	5	4	4	5	2	5	5	4	2	5	4	5	4.3
CO4	5	5	4	5	4	5	5	3	4	5	4	1	5	2	5	4.1
CO5	5	5	4	5	4	4	5	3	4	5	4	1	5	1	5	4.0
Mean Overall Score																4.2

Result: The Score of this Course is 4.2 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

DEVELOPMENTAL BIOLOGY

UNIT – I **15 Hours**

Gametogenesis – **Fertilization -** polarity & symmetry of eggs – types of eggs – Fertilization Mechanism, Physiology & theories – parthenogenesis –Natural – artificial – Experiments on Artificial Parthenogenesis.

UNIT – II **15 Hours**

Cleavage – Factors influencing cleavage – fate map – blastulation and gastrulation in amphioxus, frog and chick – Experimental works of Speeman and Mangold- Development of brain and eye in frog.

UNIT – III **15 Hours**

Embryonic adaptations; Embryonic membranes and their functions in chick – placentation in mammals. Puberty – Menstrual cycle-contraception – family welfare reproductive technology; Artificial insemination - cryopreservation - IVF - Embryotransfer – Test tube babies – Bioethics.

IMMUNOLOGY

UNIT- IV **15 Hours**

Introduction - **Lymphoid organs,** cells of immune system – their role in immune response.Types of immunity – their role in parasitic, bacterial & Viral Infection, in hyper – sensitivity and graft rejection. –Antigen – Antibody reaction.

UNIT – V **15 Hours**

Immunoglobulin – types, structure, Physico chemical and biological properties – Immunoprophylaxis – Immunization schedule of children. Immuno deficiency – AIDS, Immunotechniques.

Text Books:

1. M.S.Jayaraj An Introduction to embryology Veer Bala Rastogi Publication.
2. Verma, P.S., V.K. Agarwal and Tyagi, 1995. Chordate embryology. S. Chand & co., New Delhi.

Reference Books:

1. Balinsky, B.L., Introduction to embryology 1981.Saundeers, Philadelphia.
2. Berril & Corp Developmental Biology. McGraw Hill Book Company, MC.,New York.
3. Majumdar, N.N. 1990. Text Book of Vertebrate embryology. Tata McGraw – hill Publishing company Ltd. New Delhi.
4. McEwen, R.S., 1969.Vertebrate Embryology. Oxford and IBH Publishing Co., New Delhi.
5. Jain, P.C 1998, Elements of Developmental Biology. Vishal Publication, New Delhi.
6. Roitt.I.M 2000 Essential Immunology, Blackwell Scientific Publishers.
7. Paul, W.E.M. 1989,Fundamental Immunology, Raven Press, New York.
8. Kuby. J.1999, Immunology. W. H. Free man and Co. New York.
9. Current protocols in Immunology – 3 Volumes 1994 Wiley Publications.
10. Roitt. I, Brostoff, J. and Male. D. 2002. Immunology, Mosby, New York.
11. Richard, A. Golds, Thomas I, Kindt & Barbara A. Osborne 2000 Kuby Immunology, Freeman and Co.New York.

III B.Sc Zoology	ANIMAL PHYSIOLOGY	20ZO511
SEMESTER – V		HRS/WK - 5
CORE – XI		CREDIT - 4

Objective:

To impart an overview of basic physiological functions of various organ system in human.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To describe the process of nutrition and digestion

CO2: To understand the process of respiration and circulation.

CO3: To recognize excretory system and osmo-ionoregulation in fishes and mammals.

CO4: To describe nervous system and muscular system

CO5: To understand receptors and structure, secretions and functions of endocrine glands

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER V	COURSE CODE: 20ZO511					COURSE TITLE: ANIMAL PHYSIOLOGY									HOURS: 5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	4	4	5	5	4	4	5	4	1	5	1	5	4.1
CO2	5	5	4	4	4	5	5	4	4	5	4	3	5	1	5	4.2
CO3	5	5	4	4	4	5	5	4	4	5	4	1	5	1	5	4.1
CO4	5	5	4	4	4	5	5	4	4	5	4	1	5	1	5	4.1
CO5	5	5	4	4	4	5	5	4	4	5	4	2	5	1	5	4.1
Mean Overall Score																4.1

Result: The Score of this Course is 4.1 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I **15 Hours**

NUTRITION AND DIGESTION

Introduction– Food requirements – Carbohydrates, proteins, fats, minerals, and vitamins. Digestive enzymes and their role in digestion – absorption and assimilation.

UNIT – II **15 Hours**

RESPIRATION AND CIRCULATION

Introduction – Respiratory Pigments and functions. Transport of gases [Co2 and O2] – Respiratory quotient. Circulation Types, Composition, Properties and Function of Blood – Human – Cardiac Cycle – Cardiac Rhythm – Origin of heart Beat – Regulation of heart Beat – ECG – Blood Pressure – Factors Contributing to heart Problems – coronary circulation.

UNIT – III **15 Hours**

EXCRETION AND OSMOIONOREGULATION

Introduction – kinds of excretory products – Kidney - structure and Mechanism of urine formation in mammals, hormonal regulation of excretion. Kidney failure and Transplantation. Osmoionoregulation in fishes and mammals.

UNIT – IV **15 Hours**

NEUROMUSCULAR CO-ORDINATION

Nervous tissue – Neuron – Structure, types of neurons. Nerve impulse – Synapse – Synaptic transmission of impulses – Neurotransmitters. Muscles – Types of muscles – Muscle Proteins – Mechanism of contraction – Cori cycle – Theories of muscle contraction.

UNIT – V **15 Hours**

RECEPTORS AND ENDOCRINE SYSTEM

Receptors – Photoreceptor – mammalian eye –structure of retina – visual pigments – physiology of vision – phonoreceptors – mammalian ear- Organ of Corti – working mechanism – phonoreception in bat. Endocrine glands – structure, secretions and functions of endocrine glands of vertebrates – Pituitary, Hypothalamus, Thyroid, Parathyroid, Adrenal, Thymus, Islets of langherhans, Testis and Ovary.

Text Books:

1. Verma, P.S, Tyagi B.S. and Agarwal V.K. 2000. Animal Physiology. S. Chand Publication.
2. Sambasivaiah, Kamalakara rao and Augustine chellappa 1990. A Text book of Animal physiology and ecology, S. Chand & co., Ltd., New Delhi – 110 055.

Reference Books:

1. Parameswaran, Anantakrishnan and Ananta Subramanyam, 1975. Outlines of Animal Physiology, S. Viswanathan [printers & Publishers] Pvt. Ltd.
2. William S. Hoar, 1976. General and comparative physiology, prentice Hall of India Pvt. Ltd., New Delhi. 110 001.
3. Wood.D.W, 1983, Principles of Animal Physiology 3rd Ed.,
4. Prosser,C.L. and Brown, 1985, Comparative Animal Physiology, Satish Book Enterprise, Agra – 282 003.

III B.Sc Zoology	**APPLIED ENTOMOLOGY**	**20EZ512A**
SEMESTER – V		**HRS/WK – 5**
ELECTIVE-I (Compulsory)		**CREDIT – 4**

Objective:

1. To provide extensive knowledge in the field of Entomology.
2. The familiarity between insect and environment was highlighted to the entomological research in many directions which have immense value in the control measures various disease causing insects.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To describe the economic classification of insects

CO2: To understand the types of insect development

CO3: To know pests of stored products and their control

CO4: To describe pest control methods and application

CO5: To understand the production and marketing of pesticides

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER V	COURSE CODE: 20EZ512A					COURSE TITLE: ELECTIVE-I APPLIED ENTOMOLOGY								HOURS:5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	5	4	4	4	5	2	2	3	2	5	4	5	4.0
CO2	5	5	4	5	3	4	4	4	3	2	3	2	5	3	5	3.8
CO3	5	5	4	5	4	4	4	3	2	2	3	2	5	5	5	3.9
CO4	5	5	4	5	5	4	4	3	1	3	3	2	5	5	5	4.0
CO5	5	5	5	5	5	4	4	2	1	3	3	2	5	5	5	4.0
Mean Overall Score																3.9

Result: The Score of this Course is 3.9 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I **15 Hours**

INTRODUCTION – **economic classification of insects** - Types of pests – types of damage caused by pests in crops – causes for insects assuming pest status – outbreak of pests.

UNIT – II **15 Hours**

TYPES OF INSECT DEVELOPMENT – ametabola and metabola (hemi metabola, holometabola, paurometabola and hypermetabola) - Pests of agricultural importance, their bionomics, life cycle and control measures of paddy, ground nut, cotton, tomato, coffee & Banana.

UNIT – III **15 Hours**

PESTS OF STORED PRODUCTS AND THEIR CONTROL – Household pests – cockroach and termities – and their control – pest in relation to public health – rodents and their control. Mosquitoe borne diseases and their control measures.

UNIT- IV **15 Hours**

PEST CONTROL METHODS AND APPLICATION: cultural, mechanical, biological and chemical methods – classification of pesticides – LC 50 and LD 50 values – First Aid & precautions in handling pesticides – pesticide spraying appliances. Residual effects of pesticides on non target organisms.

UNIT – V **15 Hours**

PESTICIDE INDUSTRY - production and marketing – recent trends in pest control – pheromones, attractants, repellants and chemosterilants Integrated pest management, its importance & applications.

Text Books:

1. Vasantharaj David and T. Kumaraswami 1988. Elements of Economic Entomology Popular Book Depot, Chennai.
2. Nayar, K.K., Ananthakrishnan, T.N. and B.V. David 1992 General and Applied Entomology Tata McGraw, New Delhi.
3. P.G. Fenemore and Alka Prakash 1997 Allied Entomology, Wiley Eastern Ltd., New York

Reference Books:

1. Wigglesworth J.B., 1994. Insect Physiology, Chapman and Hall, London.
2. Temphare D.B., 1984 A. Text Book of Insects Morphology, Physiology and Endocrinology. S. Chand and Co., New Delhi.
3. A.Upadhyaya, K.Upathyaya and N.Nath, 2003 Biophysical chemistry, Principles and Techniques,3rd Ed, Himamalaya publishing house.
4. H.B.Bull, F.H.Davis, 1971. An introduction to physical Biochemistry 2nd Ed, Philadelphia
5. Gurumani.N 2006. Research methodology for biological sciences MJP publ. Chennai.

III B.Sc Zoology	ELECTIVE – II PUBLIC HEALTH AND HYGIENE	20EZ513B
SEMESTER – VI		HRS/WK – 4
ELECTIVE –II (Optional)		CREDIT – 3

Objective:

1. To impart awareness on Public Health and Hygiene
2. To create knowledge on Health Education.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To understand public health and hygiene

CO2: To realize environment and health hazards

CO3: To understand the communicable diseases and their control measures.

CO4: To understand the non-communicable diseases and their control measures

CO5: To know the health education in India

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER VI	COURSE CODE: 20EZ513B					COURSE TITLE: ELECTIVE - II PUBLIC HEALTH AND HYGIENE										HOURS:4	CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10		
CO1	5	5	2	3	3	5	5	3	2	4	2	3	5	3	5	3.7	
CO2	5	5	2	3	3	5	5	3	2	4	2	3	5	3	5	3.7	
CO3	5	5	4	3	3	5	5	3	2	4	2	3	5	3	5	3.8	
CO4	5	5	4	3	3	5	5	3	2	4	2	3	5	3	5	3.8	
CO5	5	5	4	3	3	5	5	3	2	4	2	3	5	3	5	3.8	
Mean Overall Score																3.8	

Result: The Score of this Course is 3.8 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT-I **12Hours**

Scope of Public health and Hygiene – nutrition and health – classification of foods – Nutritional deficiencies - Vitamin deficiencies.

UNIT-II **12Hours**

Environment and Health hazards – Environmental degradation – Pollution and associated health hazards.

UNIT-III **12Hours**

Communicable diseases and their control measures such as Measles, Polio, Chikungunya, Rabies, Plauge, Leprosy and AIDS.

UNIT-IV **12Hours**

Non-Communicable diseases and their preventive measures such as Hypertension, Coronary Heart diseases, Stroke, Diabetes, Obesity and Mental ill-health.

UNIT-V **12Hours**

Health Education in India – WHO Programmes – Government and Voluntary Organizations and their health services – Precautions, First Aid and awareness on sporadic diseases.

Text Books:

1. Park and Park, 1995: Text Book of Preventive and Social Medicine – Banarsidas Bhanot Publ. Jodhpur – India.
2. Dubey, R.C and Maheswari, D.K. 2007 : Text Book of Microbiology – S. Chand & Co. Publ. New Delhi – India.

Reference Books:

1. Verma, S. 1998 : Medical Zoology, Rastogi publ. – Meerut – India
2. Singh, H.S. and Rastogi, P. 2009 : Parasitology, Rastogi Publ. India

III B.Sc Zoology	ENVIRONMENTAL BIOLOGY	20ZO614
SEMESTER – VI		HRS/WK – 5
CORE – XII		CREDIT – 4

Objective:

1. To learn the scope of environmental biology, importance of protection and conservation of wild life to maintain the ecosystem balance.
2. To create awareness about the environmental problems and motivate the students to participate in environment protection and sustainable utilization of natural resources.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To realize the scope and concept of environmental biology

CO2: To describe structure and functions of ecosystem.

CO3: To understand biogeochemical cycles and animal association

CO4: To describe population and community of an ecosystem and management of natural resources

CO5: To get knowledge on environmental degradation and their effects and remedy measures

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER VI	COURSE CODE: 20ZO614					COURSE TITLE: ENVIRONMENTAL BIOLOGY										HOURS: 5	CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10		
CO1	5	5	5	5	4	5	5	3	1	4	3	1	5	5	5	4.1	
CO2	5	5	5	5	4	5	5	3	1	4	3	1	5	5	5	4.1	
CO3	5	5	4	5	4	5	5	5	1	4	3	1	5	5	5	4.1	
CO4	5	5	4	5	4	5	5	4	1	4	3	1	5	5	5	4.1	
CO5	5	5	4	5	4	5	5	3	1	4	3	1	5	5	5	4	
Mean Overall Score																4.1	

Result: The Score of this Course is 4.1 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I **15 Hours**

Scope – concept – Branches in ecology – Autecology, synecology - types of media and substratum and their influences on animals – **Water:** Properties, Forms of water, Soft and hard water. **Air** composition – properties.**Substratum**: Soil -Types, soil formation, soil group of India, soil profile.

UNIT – II **15 Hours**

Biosphere – Hydrosphere – Lithosphere – Atmosphere – temperature: Distribution of temperature, thermal stratification – Temperature as a limiting factor, thermal adaptations. Light as a limiting factor.Ecosystem-concept, components, types, structure and functions.

UNIT – III **15 Hours**

Biogeochemical cycles – gaseous cycle [C,N2& S] sedimentary cycle, [phosphates]. **Animal association** - Intra specific and inter specific - colony formation, social organization, predation, parasitism, commensalisms, mutualism, inter specific competition – competitive principle or Gause's principle.

UNIT – IV **15 Hours**

Population: Definition – characteristics – Natality, Mortality, age distribution of Population growth forms, population fluctuation. Community Ecotone and edge effects – ecological succession. Conservation - **Wild life management,** Preservation – laws enforced – sanctuaries, National parks. **Natural resources management:** renewable and non-renewable.

UNIT – V **15 Hours**

Environmental degradation – deforestation, urbanization, population explosion and other environmental hazards – Environmental ethics and laws – Earth summits – role of governmental agencies for environmental monitoring.

Text Books:

1. Kotpal. R.L, and N.P. Bali, 1986. Concepts of Ecology, Vishal Publications, New Delhi-7
2. Rastogi V.B, and M.S. Jayaraji, 1988 – 1989 Animal Ecology and Distribution of animals, Kedarnath, Ram Nath Meerut – 250 001.

Reference Books:

1. Clark, G.L. 1954, Elements of Eology, John wiley& Sons Inc., New York, London.
2. Ananthakrishnan, T.N, and S. Viswanathan, Principles of Animal Ecology.
3. Eugene P. Odum, 1971. Fundamentals of ecology, Saunders International Student Edition, W.B. Saunders Company, Philadelphia London, Toronto.
4. Verma, P.S and Agarwal 1986, Environmental Biology, S. Chand & Co Ltd. New Delhi.

III B.Sc Zoology	ECONOMIC ZOOLOGY	20ZO615
SEMESTER – VI		HRS/WK – 5
CORE – XIII		CREDIT – 4

Objective:

1. To impart the importance of valuable animals like earth worms, silk worms, honey bees, fishes, prawns, oysters and cattle.
2. To study the rearing methods of these organisms with an economic point of view.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To acquire knowledge on vermiculture, apiculture and sericulture

CO2: To describe prawn culture, pearl culture and pisciculture

CO3: To acquire knowledge on poultry

CO4: To describe dairy farm and sheep farm

CO5: To understand future strategies for livestock development

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER VI	COURSE CODE: 20ZO615					COURSE TITLE: ECONOMIC ZOOLOGY								HOURS: 5	CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO2	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO3	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO4	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO5	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
Mean Overall Score																4.5

Result: The Score of this Course is 4.5 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I **15 Hours**

Vermiculture: Composting of Earthworms-Methods of composting.

Apiculture - Species of Honeybees –Construction of Apiary-Honey extraction – Economics of Apiculture and management.

Sericulture – Nature and economic importance of sericulture in India.

UNIT –II **15 Hours**

Prawn culture – Culture techniques of fresh water [*Macrobrachium rosenbergii*] & Marine water (*Penaeus monodon*)

Pearl culture: Formation and nature of Pearls – Commercial importance of Pearl Culture in India.

Pisciculture– Techniques of induced breeding, commercial culture of catla & catfish, By–products of fishing and its commercial values.

UNIT – III **15 Hours**

Poultry- Morphology of different breeds of Chicken – Brooding and Rearing of Chicks – Processing of Egg, Meat and By–Products of Poultry.

UNIT – IV **15 Hours**

Dairy farm - management, Milch breeds. Draught Breeds, Dual Purpose breeds and New cross Breeds of Cows and Buffaloes in India.

Sheep farm: Indigenous and Exotic breeds of sheep, management

UNIT – V **15 Hours**

Future strategies for Livestock Development – Transgenic animal Technology – Genetic Improvement for best Breeds – Economic importance of Dairy, Leather, Wool, Fur and Pharmaceutical Industries in India.

Text Books:

1. Sukla, G.S. and Upadhyay, V.B., 2000 Economic Zoology – ISBN – 81- 7133 -137 -8 Rastogi Publication, Meerut, India
2. JawaidAhsan and Subhas Prasad sinha – 2000 A Handbook on Economic Zoolgy - Chand & co., Ltd., New Delhi.

Reference Books:

1. Ashok Kumar and Prem Mohan Nigam, 1991 Economic and Applied Entomology Emkay Publication, New Delhi.
2. Shammi,Q.J. and Bhatnagar, S., 2002 Applied Fisheries Agrobios [India],Jodhpur - India
3. Major Hall, C.B. 2005 Ponds and Fish culture. Agrobios [India], Jodhpur - India
4. Keith Wilson, N.D.P., 2005 A Handbook of Poultry Practice Agrobios [India], Jodhpur - India
5. Banerjee, G. C. 1992 Poultry – III – Edition Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Banerjee, 1988 A Text book of Animal Husbandry – VIII- Edition xford& IBH Publishing co. Pvt. Ltd., New Delhi.
7. Kaushish, S.K., 2001 Trends in livestock Research Agrobios [India], Jodhpur - India
8. Ismail, S.A1997. Vermicology the Biology of Earth worm orient Longman, India.
9. Mary Violet chrishty .A 2008 Vermi technology MJP Publ. Chennai.

III B.Sc Zoology	EVOLUTION	20ZO616
SEMESTER – VI		HRS/WK – 5
CORE – XIV		CREDIT – 4

Objective:

1. To learn the outline of major transitions in evolution from origin of life, process of evolution and biological diversity.
2. To gain knowledge on natural selection, behavior and distribution of animals

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To describe the evidences of evolution

CO2: To realize the theories of evolution like Lamarckism and Darwinism,

CO3: To recognize natural selection and types of variation.

CO4: To describe mimicry behavior and distribution of animals

CO5: To understand isolation and evolution of man

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER VI	COURSE CODE: 20ZO616					COURSE TITLE: EVOLUTION										HOURS:5	CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10		
CO1	5	5	2	3	3	5	5	3	2	4	2	3	5	3	5	3.7	
CO2	5	5	2	3	3	5	5	3	2	4	2	3	5	3	5	3.7	
CO3	5	5	4	3	3	5	5	3	2	4	2	3	5	3	5	3.8	
CO4	5	5	4	3	3	5	5	3	2	4	2	3	5	3	5	3.8	
CO5	5	5	4	3	3	5	5	3	2	4	2	3	5	3	5	3.8	
Mean Overall Score																3.8	

Result: The Score of this Course is 3.8 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I **15 Hours**

Evidences for Evolution: The need of evidences for the fact of evolution –Morphological evidences, anatomical evidences, Embryological evidences, Physiological evidences and Biochemical evidences.

UNIT – II **15 Hours**

Theories of Evolution: Lamarckism- principles and criticism, Neolamarckism, Darwinism-principles and criticism, NeoDarwinism, De vries concept of Mutation. Modern version of Mutation theory.

UNIT – III **15 Hours**

Natural selection: Types, stabilizing selection, diversifying selection and directional selection. **Variation:** Types of variation, factors causing variation.

UNIT-IV **15 Hours**

Mimicry – types of mimicry - mimicry and evolution: Batesian mimicry and mullerian mimicry and evolution, Fossils – Fossilization - living fossils. Distribution of animals: methods, classification and patterns of distribution.

UNIT – V **15 Hours**

Isolation – Premating and post mating isolating mechanism, speciation – role of isolation in speciation. **Evolution of man** –Biological evolution of man, fossils of human evolution - cultural evolution of man.

Text Books:

1. Agarwal, V.K and Usha Gupta –1990. Evolution and animal distribution, Chand and Co.,
2. Veer BalaRastogi. Organic Evolution, Meerut Publications.

Reference Books:

1. Dodson,E.O.. Evolution, Reinhold, Newyork.
2. Francisco.J.Ayla – Evolution, Surject publication.
3. Gopalakrishnan.T.S. IttaSambasivaiah and A.P.KamalakaraRao. Principles of organic Evolution, Himalaya publishing house.
4. Ranganathan T.K., Evolution. 1994 Rainbow Printers, Palayankottai.
5. Arumugam.N. Organic Evolution, 2009 Saras. Publ. Nagarcoil.

III B.Sc Zoology	ELECTIVE-III AQUACULTURE	20EZ617A
SEMESTER – VI		HRS/WK – 4
ELECTIVE-III (Compulsory)		CREDIT – 4

Objective:

1. To provide basic information on production of low cost, protein rich, nutritive, edible and easily digestible human food by aquaculture.
2. To introduce new species and technique to strengthen the stocks of existing fish from natural resources by artificial recruitment.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To understand the principles of site selection for aquaculture.

CO2: To describe different types of aquaculture practices.

CO3: To know the criteria for aquaculture species selection and water quality management.

CO4: To describe nutritional requirements and feed formulation for aquaculture organisms

CO5: To acquire knowledge in Mari culture

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER VI	COURSE CODE: 20EZ617A					COURSE TITLE: ELECTIVE-III AQUACULTURE									HOURS: 4	CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	4	5	1	1	2	4	1	5	4	5	3.7
CO2	5	5	5	5	4	4	5	1	1	2	4	1	5	4	5	3.7
CO3	5	5	5	5	4	4	5	4	1	2	4	2	5	4	5	4.0
CO4	5	5	5	5	4	4	5	3	1	2	4	2	5	4	5	4.0
CO5	5	5	5	5	4	4	5	1	1	2	4	1	5	4	5	3.7
Mean Overall Score																3.8

Result: The Score of this Course is 3.8 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT I **15 Hours**

Definition, objectives and scope of aquaculture – Principles of site selection for fish farms, Factors for site selection: Ecological - water, soil types and other parameters, Biological factors, Socioeconomic factor, Political and legal factors.

UNIT II **15 Hours**

Types of aquaculture - Monoculture, Poly culture, Integrated farming- Fish cum Duck, Fish cum Poultry, Fish cum Dairy and Paddy cum Fish, Pond culture, Pen culture, Cage culture, Raft culture, Race way culture, Warm and cold water fish culture .

UNIT III **15 Hours**

Criteria for selection of variety – Seed procurement: Inn natural habitat, Bundh breeding and induced breeding- stocking management: Pre stocking and stocking. Water quality management.

UNIT IV **15 Hours**

Nutritional requirements and formulation of artificial diets.Breeding and culture of fresh water fishes – Catla, *Mrigala* and Rohu.Tilapia culture – monosex culture, procurement of male seed for monosex culture.

UNIT V **15 Hours**

Mari culture – Culture of edible oyster: spat collection methods, culture methods - pearl oyster culture, mussel culture, clam culture, sea urchin culture, sea cucumber culture – artificial breeding technique of sea cucumber.

Text Books:

1. Arumugam N. 2008. Aquaculture, Saras Publication

Reference Books

1. Fish and Fisheries in India, Jhingran,V.G., 1982, Hindustan Publishing Corporation, NewDelhi
2. Principles and practices of Pond Aquaculture, Annan, J.F, R.O.Smiterman and G. Tehebenoglous (Eds) ,1983 , Oregan State University , U.S.A.
3. Home Aquarium:aquaticgema and tropical fish ,1970, Makinos Japan Publications.
4. Aquaculture principles and practices, 2005 TVR Pillai, John Wiley Publisher.

III B.Sc Zoology	Skill Based Subject SERICULTURE	20EZ618B
SEMESTER – VI		HRS/WK - 3
Skill Based Subject (Optional)		CREDIT - 3

Objective:

1. To acquire knowledge on economic importance of sericulture.
2. To understand the species of silk moth and techniques in sericulture.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To gain knowledge on introduction and importance of sericulture

CO2: To understand classification and biology of silk moth

CO3: To describe the tools of sericulture

CO4: To get knowledge on harvesting methods in sericulture

CO5: To realize the economic status of sericulture

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER VI	COURSE CODE: 20EZ618B					COURSE TITLE: Skill Based Subject SERICULTURE								HOURS: 3	CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	5	4	4	4	3	1	2	3	1	5	2	5	3.5
CO2	5	5	4	5	4	4	4	5	3	2	3	1	5	2	5	3.8
CO3	5	5	5	5	4	4	4	4	2	2	3	1	5	2	5	3.7
CO4	5	5	5	5	4	4	4	3	2	2	3	1	5	2	5	3.7
CO5	5	5	5	5	4	4	4	3	1	2	3	1	5	2	5	3.6
Mean Overall Score																3.7

Result: The Score of this Course is 3.7 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I **12 Hours**

Introduction – Importance of sericulture– Mulberry plant - Classification of commercial varieties of mulberry. Mulberry plant cultivation practices.

UNIT – II **12 Hours**

Classification and Biology of silk moth – familiar and economically import types of silkworms – life cycle study of Bombyx mori. Diseases of silk worms -– fungal, bacterial, viral and nematode diseases, deficiency diseases and their remedial measures.

UNIT – III **12 Hours**

Tools of sericulture– cultural methods and management of mulberry silk worms - Silkworm rearing operations – Chawki rearing and late age rearing techniques.

UNIT – IV **12 Hours**

Harvesting methods- Physical and commercial characters of cocoons. Reeling operations, importance of by – products of Sericulture.

UNIT – V **12 Hours**

Economics of Sericulture – Future and progress of sericulture in India. Role of State and central silk board – employment opportunities - Prospects of sericulture as self Employment as cottage industry.

Text Books:

1. Johnson M. and Kesary M., Sericulture. Saras Publication.
2. Ganga, G. and Sculochana Chetty, J. 1997: An Introduction to sericulture Oxford – IBH Publ. Co. India.

Reference Books:

1. Ganga, G. 2003: comprehensive sericulture Vol-l, Moriculture – Oxford –IBH Puubl. Co. India.
2. Ganga, G. 2003: comprehensive sericulture Vol –II Silkworm rearing – Oxford – IBH Publ. Co. India.

III B.Sc Zoology	CORE PRACTICAL – III BIOSTATISTICS, ANIMAL PHYSIOLOGY, DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY	20ZOP63
SEMESTER – V & VI		HRS/WK – 3
CORE PRACTICAL – III		CREDIT – 4

BIOSTATISTICS:

Biological data – calculation of mean, median, mode, Mean and standard deviation.
Graphical representation – Bar, Pie, frequency distribution.
Demonstration of MS- word, MS-Excel and MS-PPT.

ANIMAL PHYSIOLOGY:

Activity of human salivary amylase in relation to PH, Enzyme concentration and Temperature.
Estimation of Oxygen consumption in a fish with reference to body weight.
Detection of nitrogenous waste products in fish tank water, frog tank water, bird excreta and mammalian urine.
Use of Kymograph Unit, B.P. apparatus, stethoscope.

DEVELOPMENT BIOLOGY:

Study of the following prepared slides / museum specimens.
Section of testis and Ovary [Mammalian].
Slides of Mammalian sperm and ovum.
Study of Egg types – Frog's Egg, Hen's Egg.
Study of cleavage stages 2 Cell, 4Cell, 8Cell – Blastula and gastrula of Frog.
Slides of different stages of chick embryo –24 hours, 33 hours,48 hours 72 hours and 96 hours.
Placenta of Sheep, Pig and Man.

IMMUNOLOGY:

Study of Antigen – Antibody reaction – Human Blood grouping [ABO and Rh].
Study of prepared slides of histology: Thymus, Spleen, Bone marrow, Lymph node.

III B.Sc Zoology	CORE PRACTICAL - IV ENVIRONMENTAL BIOLOGY, ECONOMICZOOLOGY AND EVOLUTION	20ZOP64
SEMESTER – V & VI		HRS/WK – 3
CORE PRACTICAL – IV		CREDIT – 4

Estimation of Dissolved oxygen, salinity, pH, Free CO2, Carbonate and Bicarbonates in water samples.
Use of rain gauge, Maximum and Minimum thermometer, Hygrometer and Anemometer.
Plankton study – fresh water and Marine plankton.
Study of natural ecosystem and field report.

ECONOMIC ZOOLOGY:
Study of the following prepared slides / specimens.
Earthworm types [any two] – [vermiculture].
Megacolexmauritii – south Indian species – surface crawlers.
Drawidamodesta – Redsoil with calciferous gland.
Pheretimaposthuma – North Indian – Large specimen.
Eudriluseugenia – Redworm, Exotic.
Fish parasites [Lernea, Argulus].
Larvivorousfishes :
Poecelia reticulate – Guppy.
GambusiaAffinis – Gambusi.
Colisa labia – Dwarf gowrami.

Different stage of **Silk worm.**
Types of Honey **Bees.**
Common **Pests.**

EVOLUTION
Fossils – ammonite.
Living fossils – Limulus, sphenodon.
Conneting link – peripatus, archaeopteryx.
Evolutionary significance – exocoetus, draco, hippocampus.
Mimicry – monarch butterfly.
Camouflage – chameleon.

III B.Sc Zoology	MEDICAL CODING	NEW CODE
SEMESTER – VI		HRS/WK – 2
SDC		CREDIT – 2

Objective:

To impart an overview of basic concepts of medical coding

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To describe the medical terminology and coding

CO2: To know the guidelines and rules of ICD-10-CM Coding.

CO3: To understand CPT coding evaluation.

CO4: To describe surgery, digestive system, urinogenital coding.

CO5: To understand pulmonology, cardiovascular, radiology coding.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER VI	COURSE CODE:					COURSE TITLE: MEDICAL CODING									HOURS: 2	CREDITS :2
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	4	4	5	5	4	4	5	4	1	5	1	5	4.1
CO2	5	5	4	4	4	5	5	4	4	5	4	3	5	1	5	4.2
CO3	5	5	4	4	4	5	5	4	4	5	4	1	5	1	5	4.1
CO4	5	5	4	4	4	5	5	4	4	5	4	1	5	1	5	4.1
CO5	5	5	4	4	4	5	5	4	4	5	4	2	5	1	5	4.1
Mean Overall Score																4.1

Result: The Score of this Course is 4.1 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT –I: **6 Hours**

The World of Health Care: Medical Terminology: Medical Ethics: Diagnostic Coding.

UNIT –II: **6 Hours**

ICD-10-CM Diagnosis Coding: Guidelines and Rules: ICD-10-CM Coding from Infections to Blood Diseases: ICD-10-CM Coding from the Digestive System to Pregnancy: ICD-10-CM. Coding from Symptoms to Complications.

UNIT –III: **6Hours**

Z Codes, S Codes and ICD-10-CM Coding Practicum: CPT Coding: CPT Coding from the Integumentary System: CPT Coding Evaluation and Management Services.

UNIT – IV: **6 Hours**

Comprehensive Surgery Coding: Musculoskeletal Coding: Digestive System Coding:Urology and Reproductive system coding: .

UNIT- V: **6 Hours**

Pulmonology and Cardiovascular coding: CPT Coding for Radiology, Pathology: Anesthesia coding: HCPCS coding.

Text Books

1. Karen Smiley 2019Medical Billing & Coding For Dummies, 3rd Edition (For Dummies (Career/Education))
2. Sandra L. Johnson and Robin Linker 2016. Understanding Medical Coding : A Comprehensive Guide:CENGAGE Learning Custom Publishing

Reference Books

1. Betsy J. Shiland Medical Terminology & Anatomy for Coding-4E Paperback – 7 October 2020.

2. Logan Taylor. Medical Billing & Coding for Beginners 2023: The Ultimate Guide to Start a Successful Career in Medical Billing & Coding to Secure a Bright Financial Future Kindle Edition

III B.Sc. Zoology	PROJECT	JZO601
SEMESTER -VI		
PROJECT		CREDIT-2

COURSE OBJECTIVES:

- To provide students with practical experience in biology and biodiversity of organisms.
- To encourage the students to learn the skills in observing and studying nature, biological techniques and scientific investigation.
- To learn the unity and diversity of organisms.
- To learn about applied branches of zoology and prepare for self-employment.

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to:

- Learn the fundamentals of animal sciences and complex interaction between living organisms.
- Understand the basic theories and principles of ecology.
- Learn about gene, genome, cell, tissue, organ and organ system.
- Learn about evolutionary history and relationship between different groups of animals
- Obtain practical knowledge on Vermiculture, Mushroom culture, Aquaculture, Sericulture etc.

COURSE CONTENT:

1. Introduction about the Projects

- Overview of project work
- Selection of project topics based on recent trends in Zoology

2. Project Design and Development

- Culturing techniques of animals
- Selection and procurement of cultivable species
- Toxicological studies, pollution studies, growth parameters and biology of animals.

3. Documentation and Report Writing

Arrangement of contents

1. Title Page
2. Bonafide Certificate
3. Acknowledgement
4. Table of contents
5. Abstract
6. Chapters of the Report
7. References
8. Appendices, if any

Appendices should be named as APPENDIX –A

Binding Specification

- Project report should be submitted with hard bound.
- The Cover should be colour printed.

Margin Specification

Top : 4 cms
Bottom : 3 cms
Left : 4.5 cms
Top : 2.5 cms

Page Numbering

All Page numbers should be typed without punctuation on the bottom center portion of the page. The Preliminary pages (table of contents and abstract) should be numberedin lowercase roman literals.

4. Presentation and Defense

- Preparing for the project presentation
- Effective communication of project work

THEMES

Students can choose a project theme from the following areas:

1. Studies on the biology of animals
Study of anatomy, behavioural ecology etc.

2. Taxonomical status of animals
Systematic classification, phylogeny of animals etc.

3. Biodiversity study
Species, genetic and ecological diversity

4. Biochemical studies
Biochemical composition, Nutritional value etc.

5. Pollution
Causes, concentration, effects of pollution etc.

6. Environmental issues
Biodiversity laws, waste management, climate change etc.

7. Culturing technology of organisms
Culturing techniques of various organisms

8. Molecular techniques
DNA study, genetical studies, molecular study etc.

9. Entomological studies
Economic classification of insects, pest control measures etc.

10. Physiology of animals
Physiological function of various system

III B.Sc Zoology	**VERMITECHNOLOGY**	**19ZOSS52**
SEMESTER - VI		
SSC-Self Study Course		**CREDIT – 2**

Unit I: INTRODUCTION

Earthworm- structures, Geographical distribution, Classification based on habitat, (i) epigeics, (ii) anecics and (iii) endogeics.

Unit II: IDENTIFICATION

i) Cocoon ii) Juvenile iii) Adult iv) Species v) Burrowing vi) Feeding vii) Casting.

Unit III: SPECIES SUITABLE FOR VERMICOMPOSTING

Species Advocated for Vermicomposting, Species used in India

Unit IV: CONVENTIONAL STEPS INVOLVED IN VERMICOMPOSTING

Steps of vermicomposting set up, Vermibed preparation, Management,

Unit V: VERMICAST

Practical –and harvesting techniques of vermicast, Marketing of vermicompost.

REFERENCES:

1. S. Gajalakshmi, Indian Journal of Biotechnology Vol 3, October 2004, pp 486-494.

2. T. Ganesh kumar, Lambert Academic Publishing, 2013.

3. T. Ganesh kumar, Bioresources and Bioprocessing, 2014, 1:26.

QUESTION PAPER PATTERN

THEORY EXAMINATION

Continuous Internal Assessment (CIA) 25marks

1. Two Internal Examinations	15 marks
2. Assignment/ Seminar	5 marks
3. Attendance	5 marks
Total	**25 marks**

Semester Examination (75 marks)

Time: 3Hrs **Max. Marks: 75**

A Question paper consists of three parts

Part-A
10 very short answer questions without choice. Each question is to be answered in about 50 words. Two questions from each unit. Each answer is to be valued out of 2 marks.

Part-B
5 questions are to be answered in either or type. Each question is to be answered in about 300 words. Two questions from each unit. Each answer is to be valued out of 5 marks.

Part-C
3 questions are to be answered out of 5 questions given, one question from each unit to be answered in about 1000 words. Each answer is to be valued out of 10 marks.

Part-A
Very Short Answers (50 words) 10 questions each 2 marks. (10x2=20 Marks)

Part-B
Short Answers (300 words) 5 question each 5 marks. (5x5=25 Marks)

Part-C
Essay questions (1000 words) 3 questions each 10 marks. (10x3=30 Marks)

TOTAL **75 Marks**

PRACTICAL EXAMINATION

Continuous Internal Assessment (CIA) (40 marks)

Based on the periodical evaluation of Record, Observation record and Experiments assessed by the staff incharge.

External Examination (60 marks)

Time: 3 Hrs

Practical	- 50marks
Record	- 10marks
Total	**- 60marks**

I B.Sc Zoology	FIELD VISIT/INDUSTRIAL VISIT	XFZO31
SEMESTER – II		HRS/WK-0
EC-1		CREDIT-1

Guidelines and Regulations for Field Visit/Industrial Visit for B.Sc. Zoology Students (2nd Semester)

Purpose

1. To familiarize students with the practical knowledge in biological science.
2. To enhance their understanding of concepts through direct observation and interaction.
3. To motivate students towards career opportunities in Zoology and their related fields.

Eligibility and Participation

1. All 2nd-semester B.Sc. Zoology students are eligible to participate.
2. Participation is mandatory unless exempted for valid reasons (e.g., medical or personal emergencies).
3. Students must complete all prerequisite tasks, including reading relevant background material, before the visit.

Planning and Coordination

1. **Approval**: The visit must be approved by the Head of the Department (HoD) and the institution's administration.
2. **Selection of Venue**: The venue should align with the syllabus, such as Research laboratories, Hatcheries, Aquaculture, Apiculture and Sericulture industries etc.
3. **Date and Duration**: The visit should ideally be scheduled during weekends or holidays to avoid disruption of regular classes and should not exceed one day.
4. **Faculty Involvement**: Faculty members will accompany students to provide academic guidance and ensure discipline.

Conduct During the Visit

1. **Behavior**: Students must adhere to professional conduct and demonstrate respect towards industry professionals and staff.
2. **Safety**: Strict adherence to safety protocols outlined by the host organization is mandatory.
3. **Queries**: Students are encouraged to ask relevant questions to enhance learning.

Documentation and Evaluation

1. **Report Submission**: Each student must submit a detailed report on the visit, including:
    - Objectives of the visit.
    - Observations and insights.
    - Relevance to their academic curriculum.

2. **Evaluation**: The report will be evaluated as part of the internal assessment or for extra credit.
3. **Feedback**: Students will also provide feedback on the visit to improve future planning.

Financials

1. Transportation costs, entry fees, and other expenses may be covered by the institution or shared among students.
2. Students requiring financial assistance can approach the department for support, subject to approval.

Code of Conduct

1. Students must follow the instructions of accompanying faculty and hosts at all times.
2. Any act of indiscipline will lead to disciplinary action as per institutional policies.

Follow-Up Activities

1. Post-visit discussions or presentations may be organized to consolidate learning.
2. Exceptional reports or observations may be displayed on the departmental notice board or included in newsletters.

II B.Sc Zoology	INTERNSHIP	XIZO501
SEMESTER – IV		HRS/WK-0
EC-2		CREDIT-1

Guidelines and Regulations for Internship for B.Sc. Zoology Students (4th Semester)

Purpose

1. To provide students with hands-on experience in Biology-related industries, research institutions, or laboratories.
2. To develop technical, analytical, and professional skills relevant to their field of study.
3. To enhance understanding of workplace dynamics and career opportunities in Zoology.

Eligibility

1. All 4th-semester B.Sc. Zoology students are required to undertake an internship as part of their academic curriculum.
2. Students must maintain a minimum attendance and academic performance to qualify for internship placements.

Internship Duration and Timing

1. The internship should be undertaken during the 4th semester, typically over a period of minimum 5 days.
2. The internship should ideally be scheduled during semester breaks or as per the convenience of the host organization.

Selection of Internship Organization

1. **Host Organizations**: Suitable options include research institutions, industries, Medical laboratories, observatories, universities, and organizations involved in culture practices (Aquaculture, apiculture, sericulture etc.).
2. **Approval**: Students must obtain prior approval from the Department for the chosen internship organization.
3. **Assistance**: The institution may assist students in identifying suitable internships through established collaborations.

Responsibilities of Students

1. **Application Process**:
    - Submit a formal application to the host organization.
    - Provide details of the selected internship to the department for approval.
2. **Professional Conduct**:
    - Adhere to the rules and regulations of the host organization.
    - Demonstrate punctuality, discipline, and a commitment to learning.
3. **Learning Objective**:

- Actively participate in tasks assigned by the host organization.

Supervision and Monitoring

1. **Faculty Mentor**: A designated faculty member will serve as a mentor to guide students during their internship.
2. **Industry Supervisor**: The host organization will appoint a supervisor to oversee the student's progress and provide feedback.
3. **Periodic Updates**: Students may be required to submit periodic progress updates to their faculty mentor.

Assessment and Documentation

1. **Internship Report**:
    - Students must prepare and submit a detailed internship report upon completion, including:
        - Objectives of the internship.
        - Activities undertaken.
        - Key observations and learning outcomes.
        - Certificate issued from host organization.
    - The report must be signed by the faculty mentor.
2. **Evaluation**: The internship will be graded based on:
    - Report quality.

Financial and Logistical Arrangements

1. **Expenses**: Students are responsible for transportation, accommodation, and other expenses unless covered by the host organization or institution.
2. **Stipend**: Any stipend offered by the host organization is at their discretion.

Code of Conduct

1. Students must maintain the highest standards of professionalism and integrity throughout the internship.
2. Any misconduct will be subject to disciplinary action as per institutional policies.

b. M.Sc. ZOOLOGY

I M.Sc., Zoology	STRUCTURE AND FUNCTIONS OF INVERTEBRATES	PZO11
SEMESTER – I		HRS/WK – 7
CORE I		CREDIT – 5

Objective:

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

Course Outcomes (CO's):

On completion of the course students will be able

CO1: Remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.

CO2: To understand the evolutionary process and Organization of coelom.

CO3: To Understand the Nutrition, Digestion and Respiration of invertebrates.

CO4: To know the Excretion and nervous system of invertebrates**.**

CO5: To understand Larval forms of invertebrates and its Evolutionary significance

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER I	COURSE CODE: PZO11					COURSE TITLE: STRUCTURE AND FUNCTIONS OF INVERTEBRATES								HOURS: 7	CREDITS:5
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	5	5	5	3	2	4	4	2	5	1	5	4.1
CO2	5	5	5	5	5	4	5	5	2	4	4	2	5	2	5	4.2
CO3	5	5	5	5	5	4	5	5	2	4	4	2	5	3	5	4.3
CO4	5	5	5	5	5	4	5	5	3	4	4	2	5	3	5	4.3
CO5	5	5	5	5	5	4	5	4	2	4	4	2	5	3	5	4.2
Mean Overall Score																4.2

Result: The Score of this Course is 4.2 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT - I: **21 Hours**

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 Hours**

Organization of coelom: Acoelomates; Pseudocoelomates; Coelomates: Protostomia and Deuterostomia; Locomotion: Flagella and ciliary movement in Protozoa; Hydrostatic movement in Coelenterata, Annelida and Echinodermata

UNIT -III: **21 Hours**

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 Hours**

Excretion: Organs of excretion: coelom, coelomoducts, Nephridia and Malphigian tubules; Mechanisms of excretion; Excretion and osmoregulation. Nervoussystem: Primitive nervous system: Coelenterata and Echinodermata; Advanced nervous system: Annelida, Arthropoda (Crustacea and lnsecta) and Mollusca (Cephalopoda); Trends in neural evolution

UNIT -V: **21 Hours**

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

TEXT BOOKS

1. Ekambaranatha Ayyar, M. (1973). *A Manual of Zoology – Part I: Invertebrata*. S.Viswanathan (Printers and Publishers) Pvt., Ltd. Madras.
2. Ekambaranatha Ayyar, M. (1973). *A Manual of Zoology Part – II: Chordata*. S.Vishvanathan Printers and Publishers, Pvt. Ltd., Madras.
3. Jordan, E. L. and P. S. Verma, (2017). *Chordate Zoology and Elements ofAnimal Physiology,* S. Chand & Co., Ltd., New Delhi.
4. Jordon, E. L. and P.S Verma, (2015). *Invertebrate Zoology*. S. Chand and Co. Ltd., New Delhi.
5. Saxena, R.K. and S. Saxena. (2015). *Comparative Anatomy of Vertebrates*, M.V.Learning, UK.
6. Wells, H.G. (2018). *Text Book of Biology, Part 1: Vertebrata,* Createspace Publishing Company, USA.
7. Arumugam, N., T. Murugan, B. Ramanathan and M.G. Ragunathan. (2019). *A Text Book of Invertebrates,* Saras Publications, Nagercoil, Tamil Nadu.

REFERENCE BOOKS

1. Barrington E. J. W. (2012). *Invertebrate structure and function.* Affiliated East West Press Pvt. Ltd., New Delhi.
2. Brusca, R.C., W. Moore and S.M. Shuster. (2016). *Invertebrates.* Oxford University Press, USA.
3. Kent, G.C. (2015). *Comparative Anatomy of the Vertebrates*. McGraw Hill, New York.
4. Arumugam, N. (2014). *Animal diversity Volume - 1 – Invertebrata.* Saras Publication, Nagercoil, Tamil Nadu.
5. Arumugam, N. (2014). *Animal diversity Volume - 2 – Chordata*. SarasPublication, Nagercoil, Tamil Nadu.

I M.Sc., Zoology	COMPARATIVE ANATOMY OF VERTEBRATES	PZO12
SEMESTER – I		HRS/WK – 7
CORE II		CREDIT – 5

Objective:

1. Exemplifying the vertebrate origin and the intermediary position of Pro chordates between invertebrates and vertebrates.
2. Acquires the knowledge on evolution and adaptive radiation of Agnatha and Pisces.
3. Understanding knowledge about the first terrestrial vertebrates and the adaptive radiation of land animals
4. Imparting conceptual knowledge about the animal life in the air and their behaviours.
5. Understanding the origin and efficiency of mammals and evolutionary changes that occurred in the life of vertebrates.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To understand the Origin of vertebrates and their morphological features

CO2: To gain knowledge on the Vertebrate integument and its derivatives

CO3: To understand the circulatory and respiratory system of vertebrates

CO4: To know the Skeletal system and Evolution of Urinogenital system in vertebrate.

CO5: To understand Sense organs and Nervous system of vertebrates.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER I	COURSE CODE: PZO12					COURSE TITLE: COMPARATIVE ANATOMY OF VERTEBRATES									HOURS: 7	CREDITS:5
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	4	5	3	3	5	5	2	5	2	4	4.1
CO2	5	5	5	5	4	4	5	3	3	5	5	3	5	2	4	4.2
CO3	5	5	5	4	4	4	5	3	3	5	5	2	5	2	4	4.1
CO4	4	5	4	4	4	4	5	3	3	5	5	2	5	2	4	4.0
CO5	5	5	4	5	4	4	5	3	3	5	5	3	5	2	4	4.1
Mean Overall Score																4.1

Result: The Score of this Course is 4.1 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT - I: **21 Hours**

Origin of vertebrates: Concept of Pro tochordata;The nature of vertebrate morphology; Definition, scope and relation to other disciplines; Importance of the study of vertebrate morphology

UNIT - II: **21 Hours**

Origin and classification of vertebrates; Vertebrate integument and its derivatives. Development, general structure and functions of skin and its derivatives; Glands, scales, horns, claws, nails, hoofs, feathers andhairs.

UNIT -III: **21 Hours**

General plan of circulation in various groups; Blood; Evolution of heart; Evolution of aortic arches and portal systems. Respiratory system: Characters of respiratory tissue; Internal and external respiration; Comparative account of respiratory organs

UNIT - IV: **21 Hours**

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

UNIT –V: **21 Hours**

Sense organs: Simple receptors; Organs of Olfaction and taste; Lateral line system; Electroreception. Nervous system: Comparative anatomy of the brain in relation to its functions; Comparative anatomy of spinal cord; Nerves-Cranial, Peripheral and Autonomous nervous systems

TEXT BOOKS

1. Ekambaranatha Ayyar, M. (1973). *A Manual of Zoology Part – II: Chordata*. S. Vishvanathan Printers and Publishers, Pvt. Ltd., Madras.
2. Jordan, E. L. and P. S Verma. (2017). *Chordate Zoology and Elements of Animal Physiology*, S. Chand & Co., Ltd., New Delhi.
3. Saxena, R.K. and S. Saxena. (2015). *Comparative Anatomy of Vertebrates*, M.V.Learning, UK.
4. Wells, H.G. (2018). *Text Book of Biology, Part 1: Vertebrata*, Createspace Publishing Company, USA.
5. Young, J.Z. (2004). *The life of Vertebrates*. Oxford University Press, Oxford

REFERENCE BOOKS

1. Arumugam, N. (2014). *Animal diversity Volume-2: Chordata*. Saras Publication, Nagercoil, Tamil Nadu.
2. Kent, G.C. (2015). *Comparative Anatomy of the Vertebrates*. McGraw Hill, New York, USA.

I M.Sc., Zoology	**PRACTICAL I - INVERTEBRATES & VERTEBRATES**	**PZOP11**
SEMESTER – I		**HRS/WK – 6**
CORE PRACTICAL I		**CREDIT – 4**

Objective:

1. Understand the structure and functions of various systems in animals
2. Learn the adaptive features of different groups of animals
3. Learn the mounting techniques
4. Acquire strong knowledge on the animal skeletal system
5. Understand the structure and functions of various systems in animals

INVERTEBRATES

Dissection

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

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

1. *Amoeba*
2. *Entamoeba histolytica*
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. *Penaeus indicus*
3. *Emerita* (*Hippa*)
4. *Perna viridis*

Mounting

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

CHORDATES

Study the nervous system of Indian dog shark – Dissection

1. Nervous system of *Scoliodon laticaudus*/Cat fish – 5th or Trigeminal nerve (Demonstration)
2. Nervous system of *Scoliodon laticaudus*/ Cat fish – 7th or Facial nerve (Demonstration)
3. Nervous system of *Scoliodon laticaudus*/ Cat fish – 9th and 10th Vagus nerve or Glossopharyngeal & (Demonstration)

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. *Scoliodon laticaudus* (Indian dog shark)
4. *Trygon* sp. (Sting ray)
5. *Torpedo* sp. (Electric ray)
6. *Arius maculatus* (Cat fish)
7. *Belone cancila* (Flute fish)
8. *Exocoetus poecilopterus* (Flying fish)
9. *Mugil cephalus* (Mullet)
10. *Tilapia mossambicus* (Tilapia)
11. *Rachycentron canadum* (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.
2. Sinha, J., A. K. Chatterjeee, P. Chattopadhya. 2011. Advanced Practical Zoology, Arunabha Sen Publishers, pp-1070.

I M.Sc., Zoology	Elective Course - I :	EPZO13
SEMESTER – I	(Generic / Discipline Centric):	HRS/WK – 5
Elective I	MOLECULES AND THEIR INTERACTION RELEVANT TO BIOLOGY	CREDIT – 4

Objective:

1. To learn the structure, properties, metabolism and bioenergetics of biomolecules
2. To acquire knowledge on various types of enzymes, classification, their mechanism of action and regulation
3. To understand the importance and applications of methods in conforming the structure of biopolymers
4. To know the structural organization of proteins, carbohydrates, nucleic acids and lipids
5. To familiarize the use of methods for the identification, characterization and conformation of biopolymer structures.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To learn the structure of atoms, molecules and chemical bonds.

CO2: To understand the biomolecular interactions and their properties.

CO3: To acquire knowledge on various classes and major types of enzymes, classification, their mechanism of action and regulation.

CO4: To understand the structural conformation of proteins and nucleic acids**.**

CO5: To understand the stabilizing interactions in biomolecules

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER I	COURSE CODE: EPZO13					COURSE TITLE: MOLECULES AND THEIR INTERACTION RELEVANT TO BIOLOGY								HOURS: 5	CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	4	4	5	5	5	3	4	4	4	5	4	4	4.3
CO2	5	5	4	4	4	5	5	5	4	4	4	3	5	4	4	4.3
CO3	5	5	4	4	4	5	5	5	4	4	4	3	5	4	4	4.3
CO4	5	5	3	4	4	5	5	5	4	4	4	3	5	4	4	4.3
CO5	5	5	3	4	4	5	5	5	4	4	4	3	5	4	4	4.3
Mean Overall Score																4.3

Result: The Score of this Course is 4.3 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT - I: **15 Hours**

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: **15 Hours**

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: **15 Hours**

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: **15 Hours**

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: **15 Hours**

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

Text Books

1. Berg, J. M., J. L. Tymoczko and L. Stryer 2002. Biochemistry. 5th Ed., W.H. Freeman & Co., New York, pp-1050.
2. Kuchel P.W. and G. B. Ralston. 2008. Biochemistry. McGraw Hill (India) Private Limited, UP, pp-580.
3. McKee T. and J. R. McKee. 2012. Biochemistry: The Molecular Basis of Life. (7th Edition). Oxford University Press, US, pp-793.
4. Nelson D.L. and M.M. Cox. 2012. Lehninger's Principles of Biochemistry. (6th Edition). W. H. Freeman Publishers, New York, pp-1158.
5. Satyanarayana U. and U. Chakrapani, 2006. Biochemistry. (3rd Edition). Books and Allied (P) Ltd. Calcutta, pp-695.

Reference Books

1. Buchanan, B.B., W. Gruissem and R.L. Jones. 2015. Biochemistry and Molecular Biology of Plants. John Wiley and Sons Ltd., UK, pp-1280.

2. Murray, R.K., D.K. Granner, P.A. Mayes and V.W. Rodwell. 2003. Harper's Illustrated Biochemistry (26th Edition), The McGraw-Hill Companies, Inc., USA, pp-704.
3. Palmer, T. 2004. Enzymes. Affiliated East-West Press Pvt. Ltd., New Delhi, pp-416.
4. Voet D. and J.G. Voet. 2011. Biochemistry. (4th Edition). John Wiley & Sons (Asia) Pvt. Ltd., pp-1428.

I M.Sc., Zoology	Elective Course - I :	
SEMESTER – I	(Generic / Discipline Centric):	HRS/WK – 5
Elective I (Optional)	MEDICAL ENTOMOLOGY	CREDIT – 4

Objective:

1. To acquire Knowledge of the Classification of Arthropod Vector insects in Medical Entomology.
2. To study the life Cycles of Vector Insects.
3. To Learn Various Vector borne diseases - Transmission and Control Measures.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To understand the scope of Medical Entomology.

CO2: To know the Public Health importance and Control Measures of mosquito and louse.

CO3: To Understand the Public Health importance and Control Measures of Tsetse and sand fly.

CO4: To know the Public Health importance and Control Measures of Fleas and House fly**.**

CO5: To understand the Public Health importance and Control Measures of Ticks and Mites.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER I	COURSE CODE:					COURSE TITLE: MEDICAL ENTOMOLOGY									HOURS: 5	CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	5	5	5	3	2	4	4	2	5	1	5	4.1
CO2	5	5	5	5	5	4	5	5	2	4	4	2	5	2	5	4.2
CO3	5	5	5	5	5	4	5	5	2	4	4	2	5	3	5	4.3
CO4	5	5	5	5	5	4	5	5	3	4	4	2	5	3	5	4.3
CO5	5	5	5	5	5	4	5	4	2	4	4	2	5	3	5	4.2
Mean Overall Score																4.2

Result: The Score of this Course is 4.2 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT - 1: Introduction **15 Hours**

Scope of Medical Entomology- Classification of Arthropoda. Classification of Arthropods of Medical and Public Health importance. Mechanism of Transmission of diseases by Arthropods - Mechanical and Biological; Metamorphosis – Complete and Incomplete. Insect Mouth Parts – Chewing and Sucking.

UNIT - 2: Mosquitoes and Louse **15 Hours**

MOSQUITO: Morphology – Life history, vectors - diseases transmission– Control Measures.

LOUSE :- Morphology - Life history - Public Health importance – Control Measures

UNIT - 3 : **Tsetse fly and Sand fly** **15 Hours**

TSETSE FLY: Morphology - Life history - Public Health importance - Control Measures.

SAND FLY :- Morphology – Life history - Public Health importance – Control Measures.

UNIT - 4 : **Fleas and House fly** **15 Hours**

FLEAS: Morphology – Life history - Public Health importance – Control Measures.

HOUSE FLY:- Morphology – Life history - Public Health importance – Control Measures.

.**UNIT - 5** : **Ticks and Mites** **15 Hours**

TICKS : Morphology - Life history - Public Health importance – Control Measures.

MITES : Morphology – Life history - Public Health importance – Control Measures.

Text Books:

1. Tembhare, D.B. (2012). *Modern Entomology*, Himalaya Publishing House, New Delhi.
2. Tyagi , B.K. (2012). *Medical Entomology*, Scientific publishers, Chennai

Reference Book

1. Rathanswamy, G.K, (2010). A Hand book of Medical Entomology. S.Viswanatham Printers & Private & Ltd., Chennai
2. Vasantharaj Devid, and V.V. Ramamurthy, (2011). Elements of Economic Entomology.Namrutha Publications , Chennai -600116

I M.Sc., Zoology	Elective Course - II:	EPZO14
SEMESTER – I	(Generic / Discipline Centric):	HRS/WK – 5
Elective II	BIOSTATISTICS	CREDIT – 4

Objective:

1. To understand the importance of analysis of qualitative and quantitative information from biological studies.
2. To acquire skills to perform various statistical analyses using modern statistical techniques and software.
3. To Know the merits and limitation of practical problems in biological/ health management study
4. To propose and implement appropriate statistical design/ methods of analysis..

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To understand the design and application of biostatistics

CO2: To obtain knowledge on Measures of central tendency and Measures of dispersion.

CO3: To know Probability and Probability distribution.

CO4: To know Hypothesis testing and Correlation**.**

CO5: To understand Regression analysis and Analysis of variance

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER I	COURSE CODE: EPZO14					COURSE TITLE: BIOSTATISTICS								HOURS: 5	CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	4	5	4	4	2	3	5	1	5	1	5	4.0
CO2	5	5	5	5	4	5	4	3	4	4	5	1	5	1	5	4.1
CO3	5	5	4	5	4	5	4	3	3	4	5	1	5	2	5	4.0
CO4	5	5	4	5	4	5	4	3	3	3	5	1	5	3	5	4.0
CO5	5	5	4	5	4	5	4	3	2	4	5	2	5	3	5	4.1
Mean Overall Score																4.0

Result: The Score of this Course is 4.0 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT - I: **15 Hours**

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: **15 Hours**

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 - III: **15 Hours**

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

UNIT – IV: **15 Hours**

Hypothesis testing: Students '*t*' test - paired sample and mean difference'*t*' tests. Correlation: Types - Karl Pearson's Co-efficient, Rank correlation, Significance test for correlation coefficients.

UNIT - V: **15 Hours**

Regression analysis: Computation of biological data, calculation of regression co-efficient, graphical representation and prediction. Analysis of variance: one way and two way classification.

Text Books

1. Arora, P. N. and P. K. Malhan. 1996. Biostatistics, Himalaya Publishing House, Mumbai, pp-447.
2. Gurumani, N. 2005. Introduction to Biostatistics, M.J.P. Publishers, Delhi, pp-407.
3. Das, D. and A. Das. 2004. Academic Statistics in Biology and Psychology, Academic Publisher, Kolkata, pp-363.
4. Palanichamy, S. and Manoharan, M. 1990. Statistical Methods for Biologists, Palani Paramount Publications, Tamil Nadu, pp-264.

Reference Books

1. Bailey, N. T. J. 1959. Statistical in Biology, English Universities Press, London, pp-48.
2. Sokal, R. R. and F. J. Rohlf, 1973. Introduction to Biostatistics, W.H. Freeman, London, pp-467.
3. 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.

4. Zar, J.H. 1998. Biostatistical Analysis, Pearson Education (Singapore) Pvt. Ltd., Delhi, India, pp-660.
5. Bailey, N. T. J. 1994. Statistical Methods in Biology (Third Edition), Cambridge University Press, Cambridge, pp-255.
6. Wayne W. Daniel. Biostatistics: A Foundation for Analysis in the Health Sciences, John Wiley & Sons Inc, USA, pp-443.
7. Snedecor, G. W. and W. G. Cochran. 1967. Statistical Methods (Sixth Edition), Oxford & IBH Publishing Co., New Delhi, pp-593.
8. Pagano, M. and K. Gauvreau. 2008. Principles of Biostatistics (Second Edition), Cengage Learning, New Delhi, pp-525.

I M.Sc., Zoology	Elective Course - II :	
SEMESTER – I	(Generic / Discipline Centric):	HRS/WK – 5
Elective II (Optional)	TOXICOLOGY	CREDIT – 4

Objective:

1. To learn the concepts and processes involved in toxicology
2. To understand the various methods to know absorption and distribution of toxicants
3. To study the biotransformation and excretion of toxicants
4. To learn the impacts of toxicants and human beings.
5. To learn the application of antidotes.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To carry out toxicological analysis of various environmental samples

CO2: To know the Route of exposure, Absorption and Distribution of Toxicants.

CO3: To Understand the Pattern of Biotransformation and Excretion of Toxicants.

CO4: To Carry out toxicological testing using live specimen to determine toxicity of toxicants**.**

CO5: To understand Classification and Mechanism of antidotes

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER I	COURSE CODE:					COURSE TITLE: TOXICOLOGY								HOURS: 5	CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	5	5	5	3	2	4	4	2	5	1	5	4.1
CO2	5	5	5	5	5	4	5	5	2	4	4	2	5	2	5	4.2
CO3	5	5	5	5	5	4	5	5	2	4	4	2	5	3	5	4.3
CO4	5	5	5	5	5	4	5	5	3	4	4	2	5	3	5	4.3
CO5	5	5	5	5	5	4	5	4	2	4	4	2	5	3	5	4.2
Mean Overall Score																4.2

Result: The Score of this Course is 4.2 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT - I: Introduction to Toxicology **15 Hours**

Definition – Brief history of toxicology– Toxicity methods – Acute toxicity tests – Sub-acute toxicity test – Chronic toxicity test – Bio-assay – Determination of LC_{50} and LD_{50} – Dose - Response relationship.

UNIT - II: Exposure Route, Absorption and Distribution of Toxicants **15 Hours**

Route of exposure of Toxicants: Dermal route – Inhalation route – Ingestion route. Absorption of Toxicants: Introduction – Mechanism of absorption – Passive transport and carrier mediated transport – Factors affecting absorption. Distribution of Toxicants: Membrane barriers.

UNIT - III: Biotransformation and Excretion of Toxicants **15 Hours**

Biotransformation: Pattern of Biotransformation - Phase I reaction – Oxidation – Mixed Function Oxidase System – Reduction reaction – Hydrolysis – Phase II reaction – Biochemical conjugation – Glucuronidation – conjugation with Glutathione – Sulphate conjugation – Acetylation and Methylation – Amino acid conjugation - Excretion of Toxicants: Urinary excretion – Biliary excretion.

UNIT - IV: Toxic effects on human **15 Hours**

Categories of toxic effects – Local and systemic effects – Reversible and irreversible effects – Immediate and delayed effects - Effects on target organs: Neurotoxic effects – Hepatotoxic effects – Genotoxic effects – mutagenic – Teratogenic – carcinogenic effects.

UNIT - V: Antidotes **15 Hours**

Antidotes: Classification of antidotes– Mechanism of action of antidotes-Specific antidotes for metals and pesticides.

TEXT BOOKS

1. Lee, B.M. and S.Kacew. (2018). *Lu's Basic Toxicology,* Informa Healthcare.
2. Sharma, P. D., (1996). *Environmental biology and toxicology*. Rastogi Publication, Meerut, India
3. Frank C. Lu (1985). *Lu's Basic Toxicology*. Hemispher Publication Corporation Washington, N.Y. London.
4. Gupta, P.K., and Salunka, D.K., (1985). *Modern Toxicology*. Vol. I and II, Metropolitan, New Delhi.
5. Pandey, K., J. P. Shukla and S. P. Trivedi. (2013). *Fundamentals of Toxicology*, New Central Book Agency, New Delhi.
6. Chris Kent (1998). *Basics of Toxicology*. John Wiley & Sons. New York

REFERENCE BOOKS

1. Vija Byung-Mu Lee, Sam Kacew and Hyung Sik Kim. (2017). *Lu's Basic Toxicology:*

Fundamentals, Target Organs, and Risk Assessment. CRC Press, USA.

2. Stephen M. Roberts, Robert C. James and Phillip L. Williams. (2015). *Principles of Toxicology: Environmental and Industrial Applications*. Wiley Blackwell.
3. Frank A. Barile. (2017). *Principles of Toxicology Testing*. CRC Press, USA.
4. Karen E. Stine and Thomas M. Brown. (2015). Principles of Toxicology. CRC Press, USA.
5. Barile, F.A. (2013). *Principles of Toxicology Testing*, CRC Press.
6. Kamaleshwar Pandey, J. P. Shuikla and S. P. Trivedi. (2011). *Fundamentals of Toxicology*. New Central Book Agency, New Delhi.

I M.Sc., Zoology	CELLULAR AND MOLECULAR BIOLOGY	PZO21
SEMESTER – II		HRS/WK – 7
CORE III		CREDIT – 5

Objective:

1. To understand the molecular basis of cell structure and functions
2. To learn the structure and functions of various organization and cell membrane.
3. To learn bioenergetics and biogenesis
4. To learn structure and replication of DNA
5. To learn various molecular techniques.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To Acquire knowledge on cellular structure and functions..

CO2: To understand the Cellular organization, Structure and functions of Intracellular organelles.

CO3: To gain knowledge on structural and functional significances of DNA and RNA.

CO4: To know about Cell communication and cell signaling**.**

CO5: To understand Cancer cells and Carcinogens

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER II	COURSE CODE: PZO21					COURSE TITLE: CELLULAR AND MOLECULAR BIOLOGY								HOURS: 7	CREDITS:5
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	5	5	5	3	2	4	4	2	5	1	5	4.1
CO2	5	5	5	5	5	4	5	5	2	4	4	2	5	2	5	4.2
CO3	5	5	5	5	5	4	5	5	2	4	4	2	5	3	5	4.3
CO4	5	5	5	5	5	4	5	5	3	4	4	2	5	3	5	4.3
CO5	5	5	5	5	5	4	5	4	2	4	4	2	5	3	5	4.2
Mean Overall Score																4.2

Result: The Score of this Course is 4.2 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT - I: **21 Hours**

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

UNIT – II: **21 Hours**

Cellular organization: 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 and vacuoles.

UNIT – III: **21 Hours**

Cell division and Cell cycle: 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: **21 Hours**

Cell communication and cell signalling: Membrane- associated receptors for peptide and steroid hormones - signalling 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 - V: **21 Hours**

Cancer cells: 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.

TEXT BOOKS

1. De Robertis E.D.D and De. Robertis E.M.F. (2017). *Cell and Molecular Biology.* Lippincott Williams & Wilkins , USA.
2. Pollard, T.D., W.C. Earnshaw, J.L .Schwartz and G. Johnson. (2017). *Cell Biology,* Elsevier.
3. Verma P.S. and V.K. Agarwal, (2015): *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology,* S. Chand and Company, New Delhi.
4. Gupta. P.K., (2003). *Cell and Molecular Biology,* Rastogi Publication, Meerut, India.
5. Lodish. H, Berk. A, Zipursky. SL, Matiudaira. P, Baltimore. D and Darnell J. (2000). *Molecular Biology of the cell,* W.H. Freeman and company, New York.
6. Lewin.B, (2000). *Gene VII,* Oxford University Press, London.

REFERENCE BOOKS

1) Verma P.S. and V.K. Agarwal. (2016). *Cell Biology*. S. Chand & Co., New Delhi.
2) Arnold Berk, Chris A. Kaiser and Harvey Ledish. (2016). *Molecular Cell Biology*. WH Freeman, USA.
3) Malathi, V. (2012). *Essentials of Biology*. Pearson Education, Chennai, India.
4) Bruce Alberts, Alexander D. Johnson and Julian Lewis. (2014). *Molecular Biology of the Cell*. W.W. Norton & Co., USA.
5) Geoffrey M.Cooper and Robert E. Hausman. (2013).*The Cell: A Molecular Approach*. Sinauer Associates Inc., USA.

I M.Sc., Zoology	DEVELOPMENTAL BIOLOGY	PZO22
SEMESTER – II		HRS/WK – 7
CORE IV		CREDIT – 5

Objective:

1. Define the concepts of embryonic development
2. Observe various stages of cell divisions under microscope
3. Understand the formation of zygote
4. Differentiate the blastula and gastrula stages
5. Learn the distinguishing features of three different germ layers and formation of various tissues and organs

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To understand the Pattern of animal development and Gametogenesis

CO2: To know the process of Fertilization.

CO3: To Understand the Cleavage and gastrulation process.

CO4: To Understand the whole process of embryogenesis**.**

CO5: To Acquire knowledge on Post embryonic development metamorphosis

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER II	COURSE CODE: PZO22					COURSE TITLE: DEVELOPMENTAL BIOLOGY										HOURS: 7	CREDITS:5
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10		
CO1	5	5	5	5	4	4	5	3	3	5	5	2	5	2	4	4.1	
CO2	5	5	5	5	4	4	5	3	3	5	5	3	5	2	4	4.2	
CO3	5	5	5	4	4	4	5	3	3	5	5	2	5	2	4	4.1	
CO4	4	5	4	4	4	4	5	3	3	5	5	2	5	2	4	4.0	
CO5	5	5	4	5	4	4	5	3	3	5	5	3	5	2	4	4.1	
Mean Overall Score																4.1	

Result: The Score of this Course is 4.1 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I: **21 Hours**

Pattern of animal development: Chief events in animal development; History of thoughts and conceptual developments. Gametogenesis: Origin of germ cells, spermatogenesis - 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: **21 Hours**

Fertilization: Sperm aggregation, Sperm activation, Chemotaxis, Sperm maturation and capacitating 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: **21 Hours**

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 (Mammals); Fate maps - (Amphibian), Epigenesis and preformation – Formation of primary germ layers.

UNIT – IV: **21 Hours**

Embryonic Development; Embryonic development of 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.

UNIT - V: **21 Hours**

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. Cryopreservation of gametes/embryos - Ethical issues in cryopreservation

TEXT BOOKS

1. Verma, P.S. and V.K. Agarwal. (2017). *Chordate Embryology (Developmental Biology),* S. Chand and Co., New Delhi.
2. Arora, P. Mohan, (2014). *Embryology*, Himalaya publishing House, New Delhi.
3. Arumugam, N. (2014). *A Text Book of Embryology (Developmental Biology),* Saras Publications, Nagercoil, Tamil Nadu.
4. Balinsky, B.I. (2012). *An Introduction to embryology*, 4th Edition, Saunder's College Publishing Ltd, New York
5. Philip Grant (1977). *Biology of development systems,* University of Oregon
6. Berrill, N.J., and G. Karp. (1978). *Development Biology*, Tata McGraw Hill Publishing Co., Ltd, New Delhi

REFERENCE BOOKS

1) Madhavan K. S. (2018). *Developmental Biology.* Arjun Publishing House.
2) Subhadra Devi, V. (2018). *Inderbir Singh's Human Embryology,* Jaypee Brothers Medical Publishers, New Delhi.
3) Berry A.K. (2016). *An Introduction to Embryology*. Emkay Publications, New Delhi.
4) Lewis Wolpert, Cheryll Tickle and Alfonso Martinez Arias. (2015). *Principles of Development*. *Oxford University Press*, USA.
5) Jain P.C. (2013). *Elements of Developmental Biology*. Vishal Publishing Co., Punjab.
6) Carlson, B.M. (2014). *Pattens foundations of Embryology*, McGraw Hill
7) Sastry K.V. and Vinita Shukal. (2012). *Developmental Biology.* Rastogi Publication, Meerut, Uttar Pradesh.

I M.Sc., Zoology	(Generic / Discipline Centric): RESEARCH METHODOLOGY	PZO23
SEMESTER – II		HRS/WK – 5
Core V		CREDIT – 4

Objective:

1. To understand the Good Laboratory Practices
2. To learn the working principles of different instruments
3. To gain the knowledge on techniques of histology and histochemistry
4. To acquire knowledge on the basic principle and application of various modules of light and electron microscopy.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To Understand the implications of GLP

CO2: To Gain the knowledge on techniques of histology and histochemistry

CO3: To Learn the working principles of different microscopy..

CO4: To know the working principles of Centrifuges, Chromatography, Electrophoresis**.**

CO5: To understand the Principles and Applications of tracer techniques in biology

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER II	COURSE CODE: PZO23					COURSE TITLE: RESEARCH METHODOLOGY									HOURS: 5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	4	4	4	5	5	4	4	5	4	1	5	1	5	4.1
CO2	5	5	4	4	4	5	5	4	4	5	4	3	5	1	5	4.2
CO3	5	5	4	4	4	5	5	4	4	5	4	1	5	1	5	4.1
CO4	5	5	4	4	4	5	5	4	4	5	4	1	5	1	5	4.1
CO5	5	5	4	4	4	5	5	4	4	5	4	2	5	1	5	4.1
Mean Overall Score																4.1

Result: The Score of this Course is 4.1 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT - I: **15 Hours**

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

UNIT - II: **15 Hours**

Histology, Histochemistry, Role of Bioinformatics in research and Electron microscopy.

UNIT – III: **15 Hours**

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

UNIT – IV: **15 Hours**

Centrifuges, Chromatography, Electrophoresis, HPLC, GC-MS, PCR, ELISA and blotting

UNIT - V: **15 Hours**

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

Text Books

1. Pearse, A.G. 1968. Histochemistry: Theoretical and Applied, Vol. I, Third Edition, J & A Churchill Ltd, pp-758.
2. Lillie, R.D. 1954. Histopathologic Technic and Practical Histochemistry, Second Edition, Blakiston, New York, pp-715.
3. Hoppert, M. 2003. Microscopic Techniques in Biotechnology, Wiley-VCH GmbH, Weinheim, Germany, pp-330.

Reference books

1. Chandler, D.E. and Roberson R.W. 2009. Bioimaging: Current Concepts in Light and Electron Microscopy, Jones and Bartlet Publishers, Sudbury, MA, USA, pp440.
2. Engelbert, B. 1960. Radioactive Isotopes in Biochemistry, Elsevier Applied Science, pp-376.
3. Wolf, G. 1964. Isotopes in Biology, Academic Press, pp-173.
4. Srivastava, B. B. 2005. Fundamentals of Nuclear Physics, Rastogi Publications, pp-500.
5. Pantin, C. F. A. 1948. Microscopical Techniques, Cambridge University Press, London.

I M.Sc., Zoology	Elective Course - IV:	
SEMESTER – II	(Generic / Discipline Centric):	HRS/WK – 5
Elective III (Optional)	BASIC BIOTECHNOLOGY	CREDIT – 4

Objective:

1. To learn the basic concepts in biotechnology
2. To learn the various techniques used in biotechnology
3. To acquire biotechnological knowledge related to medical, agricultural and environmental disciplines

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To Gain knowledge on the principles of biotechnology

CO2: To understand the Techniques in Biotechnology.

CO3: To know the use of rDNA Technology in medicine.

CO4: To know the use of rDNA Technology in agriculture**.**

CO5: To understand Microbial and Environmental Biotechnology

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER II	COURSE CODE:					COURSE TITLE: BASIC BIOTECHNOLOGY								HOURS: 5	CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	5	5	5	3	2	4	4	2	5	1	5	4.1
CO2	5	5	5	5	5	4	5	5	2	4	4	2	5	2	5	4.2
CO3	5	5	5	5	5	4	5	5	2	4	4	2	5	3	5	4.3
CO4	5	5	5	5	5	4	5	5	3	4	4	2	5	3	5	4.3
CO5	5	5	5	5	5	4	5	4	2	4	4	2	5	3	5	4.2
Mean Overall Score																4.2

Result: The Score of this Course is 4.2 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT - I: Introduction **15 Hours**

Definition – Scope – Achievements of Biotechnology – Enzymes in genetic engineering - Restriction Enzymes, DNA ligase, DNA polymerase of Cloning vectors – Plasmids- Bacteriophage, Cosmids, Yeast plasmids.

UNIT - II: Techniques in Biotechnology **15 Hours**

Southern blotting, Northern blotting, Western blotting, In-situ hybridization, DNA sequencing, PCR, DNA finger printing.

UNIT - III: Medical Biotechnology **15 Hours**

rDNA Technology - Insulin, Somatotrophin, Somatostatin - hormone production, vaccines, interferons, gene therapy, monoclonal antibodies, Human Genome Project (HGP).

UNIT - IV: Agricultural Biotechnology **15 Hours**

Micropropagation, protoplast culture, Biofertilizers - Symbiotic and Non symbiotic nitrogen fixation, Biopesticides - Transgenic plants and animals.

UNIT - V: Microbial and Environmental Biotechnology **15 Hours**

Bioreactor, primary metabolites – Vitamins, alcohols, Secondary metabolites – Antibiotics, Toxins, Microbial enzyme production – amylase. Bioremediation, Microbial leaching.

TEXT BOOKS

1. Dubey. R. C., (2018). *A Text Book of Biotechnology*. S. Chand & Co. Ltd., New Delhi.
2. Lohar, P.S. (2014). *Text Book Of Biotechnology,* MJP Publishers,Chennai, Tamil Nadu.
3. Glick, B.R. and C.L Patten. (2018). *Molecular Biotechnology : Principles and Applications of Recombinant DNA,* ASM Pres, USA.
4. Clark, D.P. and N.J. Pazdernik. (2017). *Biotechnology,* Academic Cell.
5. Lohar, P.S. (2017). *Biotechnology,* MJP Publishers,Chennai, Tamil Nadu.
6. Gupta. P. K., (2009). *Elements of Biotechnology*. Rastogi & Company, Meerut.
7. Purohit, S. S. (2007). *Biotechnology, Fundamentals and Applications.* Agrobios, New Delhi.

REFERENCE BOOKS

1. Bernard R. Glick and Chery L Patten. (2017). *Molecular Biotechnology.* Taylor & Francis.
2. William J. Thieman and Michael A. Palladino. (2014). *Introduction to Biotechnology.* Pearson.
3. Singh B. D. (2015). *Biotechnology:* Expanding Horizons. Kalyani.
4. Dubey R. C. (2014). *Advanced Biotechnology*. S Chand & Co., New Delhi.
5. Pratibha Nallari and V. Venugopal Rao. (2010). *Medical Biotechnology.* Oxford University Press, USA.
6. Kumarsan, V. and N. Arumugam. (2016). *Fundamentals of Biotechnology,* Saras Publications, Nagercoil, Tamil Nadu.

I M.Sc., Zoology	PRACTICAL II – CELLULAR AND MOLECULAR BIOLOGY AND DEVELOPMENTAL BIOLOGY	PZOP22
SEMESTER – I		HRS/WK – 6
PRACTICAL II		CREDIT – 4

Objective:

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

CELLULAR 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 squamous epithelium
6. Identification of blood cells in the haemolymph of the of the cockroach/human
7. Isolation of genomic DNA from eukaryotic tissue - Demonstration
8. Isolation of total RNA from bacterial cells/tissues - Demonstration
9. Agarose gel electrophoresis of DNA -spotters
10. SDS-Polyacrylamide gel electrophoresis - spotters

DEVELOPMENTAL BIOLOGY

Gametogenesis - Observation of gametes from gonadal tissue sections

1. Oogenesis: Section through ovary of shrimp, fish, frog and mammals
2. Spermatogenesis: Section through testis of shrimp, fish, calotes and mammals

Fertilization

1. Induced spawning in fresh water fish - Demonstration
2. Observation and whole mount preparation of the chick blastoderm - 18 hours of development
3. Chick embryonic stage - 24 hours of development

4. Chick embryonic stage - 48 hours of development
5. Chick embryonic stage - 72 hours of development
6. Chick embryonic stage - 96 hours of development

Histological observation: Section through various developmental stages in chick embryo

Experimental Embryology

Regeneration in Frog Tadpoles

a. Blastema formation
b. Demonstration of regenerative process in tadpole

Metamorphosis

a. Demonstration of metamorphosis in Frog Tadpole using exogenous Iodine

Cryopreservation

c. Demonstration of cryopreservation of gametes of fin fish/shell fish – Lab visit

I M.Sc., Zoology	Elective Course - III:	EPZO24
SEMESTER – II	(Generic / Discipline Centric):	HRS/WK – 5
Elective III	ECONOMIC ENTOMOLOGY	CREDIT – 4

Objective:

1. To understand taxonomy, classification and life cycle of insects.
2. To know the method of rearing and management of diseases of beneficial insects.
3. To know the type of harmful insects, and their damage potential
4. To recognize insects which act as vectors causing diseases in animals and human.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To Understand taxonomy and classification of insects

CO2: To Know the life cycle, rearing and management of diseases of beneficial insects.

CO3: To Know the type of harmful insects, life cycle and damage potential

CO4: To understand the management of pests including natural pest control.

CO5: To Recognize insects which act as vectors causing diseases in animals and human.

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER II	COURSE CODE: EPZO24					COURSE TITLE: ECONOMIC ENTOMOLOGY								HOURS: 5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO2	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO3	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO4	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
CO5	5	5	5	5	5	5	4	4	3	5	5	2	5	4	5	4.5
Mean Overall Score																4.5

Result: The Score of this Course is 4.5 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT - I: **15 Hours**

Basic morphological concepts – Insect taxonomy upto orders – salient features with suitable examples of the insect orders – Odonata, Orthoptera, Coleoptera, Lepidoptera and Diptera. Elementary knowledge on insect system and function.

UNIT - II: **15 Hours**

Beneficial insects: Silkworm – types, life history, disease management and rearing methods - types of honey bees, life history, social organization, structural adaptation and beehive. Lac insects – life history, lac cultivation.

UNIT – III: **15 Hours**

Destructive insects: Insect pests - definition – categories of pests – types of damage to plants by insects – causes of pest outbreak – Economic threshold level – Biology of Paddy, cotton, sugarcane pests.

UNIT – IV: **15 Hours**

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: **15 Hours**

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

Test 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.

Reference Books

1. Chapman, R.F., S.J. Simpsonand A.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.

I M.Sc., Zoology	Elective Course - III:	
SEMESTER – II	(Generic / Discipline Centric):	HRS/WK – 5
Elective III (Optional)	BIODIVERSITY AND CONSERVATION	CREDIT – 4

Objective:

1. To make students to different types of biodiversity.
2. To know the values of biodiversity
3. To understand the conservation strategies of biodiversity

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To understand different types of biodiversity.

CO2: To know the values of biodiversity and the hotspots.

CO3: To identify various threats to Biodiversity.

CO4: To know in-situ and ex-situ conservation**.**

CO5: To understand Ecosystem Restoration and Management Practices

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER II	COURSE CODE:					COURSE TITLE: BIODIVERSITY AND CONSERVATION								HOURS: 5	CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	5	5	5	3	2	4	4	2	5	1	5	4.1
CO2	5	5	5	5	5	4	5	5	2	4	4	2	5	2	5	4.2
CO3	5	5	5	5	5	4	5	5	2	4	4	2	5	3	5	4.3
CO4	5	5	5	5	5	4	5	5	3	4	4	2	5	3	5	4.3
CO5	5	5	5	5	5	4	5	4	2	4	4	2	5	3	5	4.2
Mean Overall Score																4.2

Result: The Score of this Course is 4.2 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Unit – I: **15 Hours**

Introduction- Definition, Genetic diversity, Species diversity, Ecosystem diversity: Structural and functional aspects. Bio-geographic classification of India. Basic concepts of conservation biology. Current practice in conservation: conservation of genetic diversity, conservation of species diversity, conservation of ecosystem diversity, relevance of ecosystem diversity as well as services in conservation

Unit – II: **15 Hours**

Value of Biodiversity- Intrinsic, consumptive, productive use, social, ethical, aesthetic and option values. Utilitarian values of biodiversity- goods, services and information. Biodiversity and ecosystem functioning. Biodiversity at global, national and local levels. India as a Mega Diversity Nation. Hotspots of Biodiversity.

Unit – III: **15 Hours**

Threats to Biodiversity- Habitat loss, pollution, species introduction, global climate change, overexploitation, poaching of wildlife. Rare species, genetic diversity of rare species, habitat loss and fragmentation. Extinction: mass extinction, extinction process, ecosystem degradation, over exploitation, invasive species. Human factors: social factors, economics, politics and action. Endangered and endemic species of India, common plant species, common animal species.

Unit – IV: **15 Hours**

Conservation of Biodiversity- Strategies for conservation: In-situ and ex-situ conservation-environmental assessment, protected areas-biosphere reserves, national parks, sanctuaries, tiger reserves-project tiger. Ex situ conservation-Managed ecosystems, biological resources and gene banks, botanical gardens, bio-parks. In situ conservation.- Protected areas, Wildlife sanctuaries, National parks, Biosphere reserves. Strategies for ex situ conservation – Botanical Gardens, Seed banks, Field gene banks, Test tube gene banks, pollen banks, DNA bank, in vitro conservation.

Unit – V: **15 Hours**

Ecosystem Restoration and Management Practices- Global biodiversity and its importance, Different approaches of biodiversity conservation and management, registering biodiversity. Valuing biodiversity resources and their contribution to agriculture, community health and environment. Techniques of species reintroduction and restoration of the degraded habitat. Biodiversity policy and legislation. Wildlife conservation and management: Status of biodiversity conservation in India.

Text Books

4. Sharma.P.D., 1995. Environmental Biology and Toxicology. Rastogi and Company, Meerut, India.
5. Trivedi P.R.,& Gurdeepraj., 1992. Environmental Biology. Akashdeep Publishing House, New Delhi.
6. Pal, B.P.,1982 Environmental Conservation and Development, Nataraj Publishers, Dehra Dun, India.
7. Agarwal, K.C., 1989. Environmental Biology. Agro Botanical Publishers, India.
8. Krishnamoorthy, K.V (2004) An Advanced text book on Biodiversity- principles and Practice: Oxford and IBH publishing company Pvt. Ltd. New Delhi.

9. Krishnamurthy, K.V. (2003). Text book on Biodiversity, Science Publishers, New Hampshare.

Reference Books

1. Trivedi, P.R.& Gurdeepraj., 1992. Water Pollution. Akashdeep Publishing house, New Delhi.
2. Break Mely, W.1980. Chemicals in the Environment. Marshal Dokker INC Newyork.
3. Irving Sax, N.1974. Industrial Pollution. Van Nostrand Raingold Co., Newyork.
4. Pandey G.N.& G.C.Carney, 1989. Environmental Engineering. Tata McGraw-Hill Publishing Co., Ltd.
5. Gabriel M. (2000) Biodiversity and conservation Oxford and IBH publishing company Pvt Ltd. New Delhi.

QUESTION PAPER PATTERN

THEORY EXAMINATION

Continuous Internal Assessment (CIA) 25marks

1. Two Internal Examinations	15 marks
2. Assignment/ Seminar	5 marks
3. Attendance	5 marks

Total **25 marks**

Semester Examination (75 marks)

Time: 3Hrs **Max. Marks: 75**

A Question paper consists of three parts

Part-A
10 very short answer questions without choice. Each question is to be answered in about 50 words. Two questions from each unit. Each answer is to be valued out of 2 marks.

Part-B
5 questions are to be answered in either or type. Each question is to be answered in about 300 words. Two questions from each unit. Each answer is to be valued out of 5 marks.

Part-C
3 questions are to be answered out of 5 questions given, one question from each unit to be answered in about 1000 words. Each answer is to be valued out of 10 marks.

Part-A
Very Short Answers (50 words) 10 questions each 2 marks. (10x2=20 Marks)

Part-B
Short Answers (300 words) 5 question each 5 marks. (5x5=25 Marks)

Part-C
Essay questions (1000 words) 3 questions each 10 marks. (10x3=30 Marks)

TOTAL **75 Marks**

PRACTICAL EXAMINATION

Continuous Internal Assessment (CIA) (40 marks)

Based on the periodical evaluation of Record, Observation record and Experiments assessed by the staff incharge.

External Examination (60 marks)

Time: 3 Hrs

Practical	- 50marks
Record	- 10marks
Total	**- 60marks**

II B.Sc (Microbiology)	CLASSICAL GENETICS & BIO-STATISTICS	19AZMB31
SEMESTER - III		HRS/WK – 5
ALLIED		CREDIT – 4

(For II Year B.Sc., Microbiology)

Objective:

To provide basic knowledge in the field of genetics and applications of biostatistics for data analysis.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To understand the history of genetics and Mendel's laws

CO2: To understand recombination in Eukaryotes

CO3: To describe molecular, human and and cytogenetics

CO4: To obtain knowledge on introduction, scope, importance and functions of biostatistics

CO5: To analyze correlation, regression and test of significance

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER III	COURSE CODE: 19AZMB31					COURSE TITLE: CLASSICAL GENETICS & BIO-STATISTICS									HOURS: 5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	3	5	4	5	4	2	2	4	4	3	5	2	5	3.9
CO2	5	5	4	5	4	4	4	2	3	4	4	3	5	2	5	4.0
CO3	5	5	4	5	4	4	4	2	4	4	4	3	5	2	5	4.0
CO4	5	5	4	5	4	4	4	2	2	4	4	4	5	2	5	4.0
CO5	5	5	4	5	4	4	4	2	1	4	4	4	5	2	5	3.9
Mean Overall Score																4.0

Result: The Score of this Course is 4.0 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I: **15 Hours**

GENETICS AND MENDEL'S LAWS:

History of genetics – Mendel's experiments: monohybrid, dihybrid Cross - hybrid vigour – pleiotropism - epistasis - lethal genes – atavism –polygenic inheritance Multiple Alleles and linkage - ABO Blood Group inheritance - Rh factor – linkage and linkage group.

UNIT – II: **15 Hours**

RECOMBINATION IN EUKARYOTES:

Crossing over –Mechanism- factors controlling crossing over – mitotic and meiotic crossing over – somatic and germinal crossing over – significance of crossing over - construction of chromosome maps –chromosomes – size, shape, structure, types and physiology of chromosomes.

UNIT – III: **15 Hours**

MOLECULAR, HUMAN AND CYTOGENETICS:

DNA as the genetic material – structure of DNA, euploidy - aneuploidy – chromosomal aberarrations - Pedigree analysis – eugenics and euphenics – inbreeding, outbreeding and hybrid vigour - population genetics.

BIO-STATISTICS

UNIT – IV: **15 Hours**

Introduction – Scope – Definition –Data collection – Methods of data collection – Classification of Data – Tabulation of Data – Diagramatic, Graphical presentation of Data – Histogram – Frequency polygon – Oogive curves. Measures of central tendency - Arithmetic mean – Median – Mode – standard deviation– mean deviation – skewness – kurtosis.

UNIT –V: **15 Hours**

Correlation – simple correlation – Rank correlation – Regression – Probability – Addition theorem – Multiplication theorem – Test of significance – Hypothesis testing – Null hypothesis – Large sample test – small sample test (Students 't' test) – chi-square test – standard error – ANOVA (Analysis of variance) – one way ANOVA.

Text Books:

1. Verma, P.S and Agarwal, V.K 2005. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology', S. Chand and Co., New Delhi.
2. P. Ramakrishnan, Biostatistics. Saras Publications 1996 A.R.P. Camp Road, Kottar, Nagarkoil, Kanyakumari District.
3. Gurumani, Elements of Biostatistics, Nithi Publishers.

Reference books:

1. Veer Bala Rastogi. 1992 .A textbook of Genetics, 9th edition, Keda Nath Ram Nath, New Delhi.
2. Karvita B. Aluwalia , 1991. 'Genetics' Wiley Eastern Ltd, New Delhi .
3. Sarin, C.1990. ' Genetics' Tata Mcgraw – Hill Publishing Co ., Ltd., New Delhi.
4. Burns. G.W .and Boltsmo, P.J. 1989. The Science of Genetics' Macmillan publishing Co ., New York.

II B.Sc (Microbiology)	CLASSICAL GENETICS & BIO-STATISTICS PRACTICALS	19AZMP31
SEMESTER – III		HRS/WK – 3
ALLIED PRACTICALS		CREDIT - 2

Genetics

1. Squash preparation of Salivary glands of chironomous larva (Giant chromosome).
2. Male & Female identification of Drosophila.
3. Observation of common Mutants of Drosophila.
4. Human Blood Grouping
5. Human pedigree construction for a family data

Biostatistics

- Mean, Median, Mode and Standard deviation.
- Correlation and Regression Analysis.

II B.Sc (Microbiology)	APPLIED ENTOMOLOGY	19AZMB42
SEMESTER – IV		HRS/WK – 5
ALLIED		CREDIT – 4

Objective:

1. To provide extensive knowledge in the field of applied entomology.
2. The familiarity between insect and environment was highlighted to various field like agricultural entomology, medical entomology andindustrial entomology

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To obtain knowledge on basic introduction of entomology

CO2: To recognize beneficial and harmful insects in the agricultural entomology

CO3: To describe vector borne diseases, control measures and awareness in medical entomology

CO4: To identify productive insects in industrial entomology

CO5: To understand pest control methods and application

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER IV	COURSE CODE: 19AZMB42					COURSE TITLE: APPLIED ENTOMOLOGY								HOURS: 5	CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)									MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10	
CO1	5	5	5	5	5	5	5	3	2	4	4	2	5	1	5	4.1
CO2	5	5	5	5	5	4	5	5	2	4	4	2	5	2	5	4.2
CO3	5	5	5	5	5	4	5	5	2	4	4	2	5	3	5	4.3
CO4	5	5	5	5	5	4	5	5	3	4	4	2	5	3	5	4.3
CO5	5	5	5	5	5	4	5	4	2	4	4	2	5	3	5	4.2
Mean Overall Score																4.2

Result: The Score of this Course is 4.2 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT – I **15 Hours**

INTRODUCTION TO ENTOMOLOGY

Definition – classification upto orders - scope- Agricultural entomology, Forest entomology, Veterinary entomology, Medical entomology, Forensic entomology, Industrial entomology.

UNIT – II **15 Hours**

AGRICULTURAL ENTOMOLOGY

Pest identification marks, nature, symptoms of damage. Any two pests - rice, Maize, pulses, sugar cane, cotton, coconut, ground nut, brinjal.

Pollinators, Destroyers of insect pests, Serve as food, Destroyers of weeds, Improve soil fertility.

UNIT – III **15 Hours**

MEDICAL ENTOMOLOGY

Life cycles of arthropod vectors - ticks, mites and fleas. Vector borne diseases: malaria, filariasis, dengue. Vector control- Chemical, Biological, Genetic and Environmental.Insecticide resistance in vectors.Drug resistance in pathogens.Importance of education, awareness and Community participation.

UNIT – IV **15 Hours**

INDUSTRIAL ENTOMOLOGY

Productive Insects (a) Honey bee: Apiculture and its scope; life history, Bee products- Honey and Bee wax, and Uses, Bee diseases. (b) Silk moth: Different types of silkworms, life cycle; Sericulture, uses of silk, silk worm diseases. (c) Lac insect: Different strains of Lac insects, uses of lac.

UNIT – V **15 Hours**

PEST CONTROL METHODS AND APPLICATION:

Cultural, mechanical, biological and chemical methods – classification of pesticides. First Aid & precautions in handling pesticides – pesticide spraying appliances.Residual effects of pesticides on non target organisms.Pesticide industry- production and marketing –Integrated pest management, its importance & applications.

Text Books:

1. Vasantharaj David and T. Kumaraswami 1988. Elements of Economic Entomology Popular Book Depot, Chennai.
2. Nayar, K.K., Ananthakrishnan, T.N. and B.V. David 1992 General and Applied Entomology Tata McGraw, New Delhi.

Reference Books:

1. P.G. Fenemore and AlkaPrakash 1997 Allied Entomology, Wiley Eastern Ltd., New York.
2. Wigglesworth J.B., 1994. Insect Physiology, Chapman and Hall, London.
3. Temphare D.B., 1984 A. Text Book of Insects Morphology, Physiology and Endocrinology. S. Chand and Co., New Delhi.
4. A.Upadhyaya, K.Upathyaya and N.Nath, 2003 Biophysical chemistry, Principles and Techniques,3rd Ed, Himamalaya publishing house.
5. H.B.Bull, F.H.Davis, 1971. An introduction to physical Biochemistry 2nd Ed, Philadelphia
6. Gurumani.N 2006. Research methodology for biological sciences MJP publ. Chennai.

II B.Sc (Microbiology)	APPLIED ENTOMOLOGY-PRACTICAL	19AZMP42
SEMESTER - IV		HRS/WK – 3
ALLIED		CREDIT -2

Major Practical

1. Methods of insect collection and preservation - Submission of insect box, Field visit.
2. Identification of at least 10 insects belonging to different orders.
3. Mounting of salivary gland of cockroach, mouth parts of cockroach, housefly, and mosquito.
4. Mounting of different types of antennae and legs of insects, wings and their venation.
5. Demonstration of digestive, reproductive (male and female) and nervous system of insects (Cockroach or Odontopus).

Spotters

1. Histological slides –T.S of testis, L.S. of ovary and types, T.S. of carpus cardiacum and T.S. of carpus allatum.
2. Life history of silkworm (egg, larva, cocoon and adult).
3. Identification of honey bee sting Identification of honey bees, drone, workers and queen.

II B.Sc (Biochemistry)	ADVANCED ZOOLOGY	AZBC401T
SEMESTER - IV		HRS/WK – 5
ALLIED		CREDIT – 4

Objective:

To understand the basic concepts of animal kingdom,Invertebrates, Chordates,cytological techniques, human genetics, developmental biology, ecology and evolution.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To describe structure and functions of some invertebrate species

CO2: To describe structure and functions of some chordate species

CO3: To analyze cytological techniques and human genetics

CO4: To understand developmental biology

CO5: To understand the basic concepts of ecology and evolution

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER IV	COURSE CODE: AZBC401T					COURSE TITLE: ADVANCED ZOOLOGY										HOURS: 5	CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10		
CO1	5	5	4	5	4	5	5	5	5	5	5	2	5	3	5	4.5	
CO2	5	5	4	5	4	5	5	5	5	5	5	2	5	3	5	4.5	
CO3	5	5	4	5	4	5	5	5	5	5	5	5	5	3	5	4.7	
CO4	5	5	4	5	4	5	5	5	5	5	5	3	5	3	5	4.6	
CO5	5	5	4	5	4	5	5	5	4	5	5	3	5	3	5	4.5	
Mean Overall Score																4.6	

Result: The Score of this Course is 4.6 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

Unit: 1 **15 Hours**

INVERTEBRATES - Structural and functional details of phylum–Protozoa-*Plasmodium vivax*, Helminthes-*Taeniasolium*, Annelida-Earthworm- Digestive system,

Unit: 2 **15 Hours**

CHORDATES- Prochordata – amphioxus- Morphological details of chordates- Pisces-shark, Amphibia -Frog, Reptiles- Calotes, Aves- pigeon, Mammalia- Rat.

Unit: 3 **15 Hours**

CYTOLOGICAL TECHNIQUES AND HUMAN GENETICS – Histological techniques – Fixation- selective fixatives- Embedding- Sectioning and Staining Principles. Mendel's experiments.Mutation, Linkage and Crossing over, Eugenics, Human chromosome, Chromosome number, Idiogram.Population genetics- Hardy Weinberg principle and its application in human population.Genetic engineering and its applications in human being.Pedigree chart and its uses.

Unit: 4 **15 Hours**

DEVELOPMENTAL BIOLOGY- Gametogenesis in mammals – Spermatogenesis, Oogenesis, Fertilization. Types of Eggs, Pattern of cleavage, Blastulation and Gastrulation in chick.Human Reproduction- Puberty, Menstrual cycle, Menopause, Pregnancy and related problems-Parturition and lactation- Human cloning- Ethics.

Unit: 5 **15 Hours**

ECOLOGY AND EVOLUTION- Principles and Applications of Environmental biology.ecological succession, ecological niche, Animal relationships, Interspecific-Antagonism, symbiosis, Parasitism, Mutualism, commensalisms. Lamarckism, Darwinism, mimicry, Fossil and Fossilization.

Books for reference:

INVERTEBRATES AND CHORDATES:

1. EkambaranathaAyyar&T.N.Ananthakrishnan (1992) Manual of Zoology Vol – I, part I & II S.ViswanathanPvt. Ltd. Chennai.
2. Jordan.E.L&P.S.Verma (2000) 'Chordate Zoology' S.Chand& Co New Delhi.

CYTOLOGICAL TECHNIQUES AND HUMAN GENETICS:

1. Verma.P.S and Agarwal.V.K (2004) Genetics, S.Chand& Co., New Delhi
2. Dalela.R.C and Verma.S.R (1970) A Textbook of Genetics, JaiprakashNath and Company., Meerut.
3. Max Levitan Tex Book of Human Genetics - Oxford University Press.

DEVELOPMENTAL BIOLOGY

1. Verma.S and AgarwalV.K(2000) Chordate Embryology S.Chand& Co. New Delhi.
2. Balinsky.B.I (1981) An Introduction to Embryology S.Chand& Co. New Delhi.
3. Saunders.J.W (1982) Developmental Biology – Pattern and Principles, Macmillan New York.

ECOLOGY AND EVOLUTION

1. Text book of Ecology & Animal Distribution by P.S.VermaV.K.AgarwalS.Chand& Co. New Delhi.
2. OdumE.P.Basic Ecology (1983) Saunders College Publishing's New York.
3. Arumugam.N (2002) Organic Evolution, Saras Publication., Nagercoil.

II B.Sc (Biochemistry)	**ADVANCED ZOOLOGY- PRACTICAL**	**AZBP401**
SEMESTER - IV		**HRS/WK – 3**
ALLIED PRACTICAL		**CREDIT -2**

MAJOR PRACTICALS

1. Dissection of digestive system and body setae in earthworm.
2. Prawn- Appendages
3. Estimation of Unit metabolism of fish.

MINOR PRACTICALS

1. Squash preparation of onion root tip for mitosis.
2. Human pedigree construction for a family data.
3. Mouth parts- Honey bee and Mosquito.

SPOTTERS

T.S. of Chick embryo- 24hrs, 48hrs, 72hrs and 96hrs, *Taeniasolium*, Placoid scale, T.S. of Pituitary gland, Adrenal gland, Thyroid gland, Testis and Ovary.

QUESTION PAPER PATTERN

THEORY EXAMINATION

Continuous Internal Assessment (CIA) 25marks

1. Two Internal Examinations	15 marks
2. Assignment/ Seminar	5 marks
3. Attendance	5 marks
Total	**25 marks**

Semester Examination (75 marks)

Time: 3Hrs **Max. Marks: 75**

A Question paper consists of three parts

Part-A
10 very short answer questions without choice. Each question is to be answered in about 50 words. Two questions from each unit. Each answer is to be valued out of 2 marks.

Part-B
5 questions are to be answered in either or type. Each question is to be answered in about 300 words. Two questions from each unit. Each answer is to be valued out of 5 marks.

Part-C
3 questions are to be answered out of 5 questions given, one question from each unit to be answered in about 1000 words. Each answer is to be valued out of 10 marks.

Part-A
Very Short Answers (50 words) 10 questions each 2 marks. (10x2=20 Marks)

Part-B
Short Answers (300 words) 5 question each 5 marks. (5x5=25 Marks)

Part-C
Essay questions (1000 words) 3 questions each 10 marks. (10x3=30 Marks)

TOTAL **75 Marks**

PRACTICAL EXAMINATION

Continuous Internal Assessment (CIA) (40 marks)

Based on the periodical evaluation of Record, Observation record and Experiments assessed by the staff incharge.

External Examination (60 marks)

Time: 3 Hrs

Practical	- 50marks
Record	- 10marks
Total	**- 60marks**

II YEAR	ENVIRONMENTAL SCIENCE	EVS301S/ EVS401S
SEMESTER – III/IV		HRS/WK – 3
AEC		CREDIT – 2

(For All UG II Year Students Any One Semester)

Objective:

The need for sustainable development is a key to the future of mankind.

Course Outcomes (CO's):

On completion of the course students will be able

CO1: To understand the natural environment and its relationships with human activities.

CO2: To demonstrate an awareness and knowledge of the intrinsic values of ecological system.

CO3: To characterize and analyze human impacts on biodiversity and its conservation.

CO4: To demonstrate an ability to integrate the many disciplines and fields that intersect with environmental concerns

CO5: To integrate knowledge and to analyze, evaluate and manage the different public health aspects of disaster events at local and global levels**.**

Relationship Matrix Course Outcomes, Programme Outcomes and Programme Specific Outcomes

SEMESTER III/IV	COURSE CODE: EVS301S/ EVS401S					COURSE TITLE: ENVIRONMENTAL SCIENCE										HOURS: 3	CREDITS:2
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)										MEAN SCORE OF CO'S	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO 10		
CO1	5	5	3	4	4	5	5	5	2	3	5	1	5	5	5	4.1	
CO2	5	5	3	4	4	5	5	5	2	3	5	1	5	5	4	4.1	
CO3	5	5	3	4	4	5	5	5	2	4	5	1	5	5	3	4.1	
CO4	5	5	3	4	4	4	5	4	2	4	5	1	5	5	3	4.0	
CO5	5	5	3	4	4	4	5	4	2	4	5	1	5	5	5	4.1	
Mean Overall Score																4.1	

Result: The Score of this Course is 4.1 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VERY HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT I : ENVIRONMENTAL STUDIES AND NATURAL RESOURCES: 9 Hours

Definition, scope and importance of environmental studies – forest resources: deforestation, mining, dams – water resources: over – utilization, floods, drought – mineral resources: exdploitation, extraction and usage – food resources: food problems, overgrazing, pesticide problems, water logging, salinity – energy resources: energy needs, renewable and non renewable energy – land resources: land degradation, landslides, soil erosion and desertification – conserving natural resources.

UNIT II: ECOSYSTEM: 9 Hours

Concept, structure and function of an ecosystem – producers, consumers and decomposers – energy flow – ecological succession – food chains, food webs and ecological pyramids – types, characteristics, structure and function of forest ecosystem, grassland ecosystem, desert ecosystem and aquatic ecosystem –

UNIT III: BIODIVERSITY: 9 Hours

Definition of biodiversity – genetic, species and ecosystem diversity – value of biodiversity – India as a mega diversity nation – hot spots – threats to biodiversity – endangered and endemic species of India – In-situ and Ex-situ conservation of biodiversity.

UNIT IV: ENVIRONMENTAL POLLUTION: 9 Hours

Cause, effects and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution and nuclear hazards – solid waste management: causes, effects, control measures and disposal of wastes – disaster management: floods, earthquakes, cyclone, land slides and tsunami.

UNIT V:

SOCIAL ISSUES, HUMAN POPULATION AND THE ENVIRONMENT: 9Hours

Water conservation, rain water harvesting, watershed management – environmental ethics: issues and possible solution – climate change, global warming, acid rain, ozone depletion, nuclear accidents and holocaust – wasteland reclamation – Environment protection Act – Wildlife protection Act – Forest Conservation Act – public awareness – Population explosion – Environment and human health – Role of Information Technology in Environment and human health.

Field work:

1. Visit to a local area to document environmental assets – river / forest / grassland/mangrove.
2. Visit to a local polluted site – urban / rural / industrial / agricultural.
3. Study of common plants, insects, birds.
4. Study of simple ecosystems – pond, river, forest, etc.,
5. Practical work

Reference Books:

1. Joseph C.Daniel,2004. Principles of Environmental Science. Brightson'sPublications,Chennai.
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013, India, Email:mapin@icenet.net

4. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi
5. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co.
6. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA,
7. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
8. 8. Trivedi R.K., Hand book of Environmental Laws, Rules Guidelines, Compliances and Standards. Vol I and II, Enviro Media9.Wanger K.D., 1998. Environmental Management. W.B. Saunders Co. Philadelphia, USA

II YEAR	ENVIRONMENTAL SCIENCE	EVST301S
SEMESTER – III		HRS/WK - 3
AEC		CREDIT - 2

(For B.A., Tamil II Year Students)

சுற்றுச் சூழல் அறிவியல்

Unit/அலகு-1 சுற்றுச் சூழ்யியல் மற்றும் இயற்கை வளங்கள்

சுற்றுச் சூழல் இயலின் இலக்கணம், நோக்கம், முக்கியத்துவம் - காடும் அதன் வளங்களும், காடுகள் அழிப்பு, சுரங்கம், நீர் தேக்க அணை – நீர் ஆதாரங்கள், பயன்பாடுகள், வெள்ளம், வறட்சி, கனிம வளங்கள் - சுரண்டல்,அளவாக எடுத்தல் (ம) பயன்பாடு உணவு வளங்கள் - உணவும் அதன் நிறை குறைகளும், அதி தீவிர மேய்ச்சல், பூச்சுக்கொல்லி (ம) உயிர்கொல்லியின் குறைகள், நீர் தேங்குதல், உப்புத்தன்மை, சக்தி வளங்கள் - சக்தியின் தேவைகள், புதுப்பிக்க கூடிய (ம) புதுப்பிக்க இயலாத சக்திகள் நில வளங்கள் - நிலவளக் குறைவு, நிலச்சரிவு, மண்சரிவு மற்றும் பாலைவனமாகுதல், இயற்கை வளங்களின் பாதுகாப்பு நன்மைகளும்.

Unit/அலகு-2 சூழல்நிலை மண்டலங்கள்

கோட்பாடு, அமைப்பு மற்றும் செயல்பாடு உற்பத்தியாளர்கள், நுகர்வோர்கள் மற்றும் சிதைப்பவர்கள் - சூழ்நிலை மண்டலத்தின் ஆற்றல் ஓட்டம் சூழியல் வழிமுறை வளர்ச்சி,உணவுச்சங்கிலி, உணவுவளை, சூழ்நிலை மண்டலங்கள் வகைகள், தன்மைகள், அமைப்பு மற்றும் செயல்பாடு – காட்டு சூழ்நிலை மண்டலம், புல்வெளி சூழ்நிலை மண்டலம், பாலைவனம் மற்றும் நீர்ச்சூழ்நிலை மண்டலம்.

Unit/அலகு-3 உயிரியப் பல்வகைமை

வரையறை, வகைகள், உயிரியப் பல்வகைமையின் பயன்கள், இந்தியா ஓர் உயிரியமிகை பல்வகைமை மண்டலம், உயிரியமிகை பல்வகைமை இடங்கள், உயிரியல் பல்வகைமைக்கு அச்சுறுத்தல், உயிரிய பல்வகைமையின் பாதுகாப்பு.

Unit/அலகு-4 சுற்றுச்சூழல் மாசுபாடு

காற்று மாசுபாடு, நீர் மாசுபாடு, மண் மாசுபாடு, கடல் மாசுபாடு, இரைச்சல் மாசுபாடு, அனல் மாசுபாடு மற்றும் கதிரியக்க மாசுபாடு – திடகழிவு மேலாண்மை, காரணிகள், விளைவுகள், தடுக்கும்முறை மற்றும் பாதுகாப்பான அப்புறப்படுத்தும் முறை பேரிடர் மேலாண்மை, வெள்ளம், நிலநடுக்கம், புயல், நிலச்சரிவு மற்றும் ஆழிப்பேரலைகள்.

Unit/அலகு-5 சமூக சிக்கல்களும் மக்கள் பெருக்கமும் சுற்றுச்சூழலும்

நீர்வள பாதுகாப்பு, மழைநீர் சேகரிப்பு, நீர்வள மேலாண்மை – சுற்றுச்சூழல் வரைமுறை சிக்கல்களும் அதன் நீர்க்கும் காரணிகளும், வானிலை மாற்றங்கள், உலகவெப்பமயமாதல், அமிலமழை, ஓசோன் சிதைவு, கதிரியக்க விபத்துகள் மற்றும் பேரிடர்கள் நீர்பிரிகை முகடு சீரமைப்பு, சுற்றுச்சூழல் பாதுகாப்பு சட்டம், வன உயிரினப் பாதுகாப்பு சட்டம், வனப்பாதுகாப்பு சட்டம், சூற்றுச்சூழல் விழிப்புணர்வு, மக்கள் தொகைப் பெருக்கம், சுற்றுச்சூழல் (ம) மனித நலன் - மனித நலனிலும், சுற்றுச் சூழலிலும் தகவல் தொழில் நுட்பத்தின் பங்கு.

QUESTION PAPER PATTERN
(For Environmental Studies)

THEORY EXAMINATION

Continuous Internal Assessment (CIA) 25 marks

1. Two Internal Examinations	15 marks
2. Assignment/ Seminar	5 marks
3. Attendance	5 marks
Total	**25 marks**

Semester Examination (75 marks)

Time: 3Hrs **Max. Marks: 75**

A Question paper consists of three parts

Part-A
20 choose the answer question. Each answer is to be valued out of 1 marks.

Part-B
5 questions are to be answered out of 8 given. Each question is to be answered in about 300 words. Each answer is to be valued out of 5 marks.

Part-C
Essay questions containing internal choice to be answered in about 1200 words. Each answer is to be valued out of 15 marks.

Part-A
Choose the answer 20 questions each 1 mark. (20x1=20 Marks)

Part-B
Short Answers (300 words) 5 question each 5 marks. (5x5=25 Marks)

Part-C
Essay questions (1200 words) 3 questions each 10 marks. (3x10=30 Marks)

Field work

TOTAL **75 Marks**

II UG	NON MAJOR ELECTIVE ORNAMENTAL FISH CULTURE	NZOFC401
SEMESTER - IV		HRS/WK - 3
NME		CREDIT - 2

Objectives:

To impart training on Ornamental fish culture technology.

To create knowledge on self employment opportunity.

UNIT – I

The potential scope of Ornamental fish culture as a Cottage Industry. Exotic and Endemic species of Aquarium Fishes.

UNIT – II

Common characters and sexual dimorphism of Fresh water and Marine Ornamental fishes such as Guppy, Molly, Sword tail, Gold fish, Angel Fish, Blue Morph, Anemone fish and Butterfly fish.

UNIT – III

Food and feeding of Ornamental fishes – use of live fish feed organisms. Preparation and composition of formulated fish feeds.

UNIT – IV

Live fish transport – Fish handling, packing and forwarding techniques.

UNIT – V

General Aquarium maintenance – budget for setting up an aquarium fish farm as a cottage industry.

Text Books:

1. Jingran V.G., 1991: Fish and fisheries in India – Hindustan Publ. co New Delhi – India.
2. Yadav. 1995: Fish and fisheries, Daya publ. co., New Delhi – India

Reference Books:

1. Shanmugam K. 1992, Fishery Biology and Aqua Culture – Leo Pathipagam – Chennai- India.
2. Mill Dick, 1993: Aquarium fish, DK Publ.Co,Inc. New York –USA
3. Hall, C.B. 2005: Ponds and Fish culture – Agrobios – Jodhpur – India.
4. Day,F. 1978: Fishes of India Vol. I & II, William Danisan& Sons, India.

QUESTION PATTERN

Written paper Max Marks: 75 Marks

Time:3 Hours

A Question paper consists of three parts

Part-A

20 Choose the Answer Questions. Equal representation to be given to all the units. Each answer is to be valued out of 1 mark.

Part-B

5 questions are to be answered in either or type. Each question is to be answered in about 300 words.

Part-C

3 questions are to be answered out of 5 questions given, one question from each unit to be answered in about 1000 words. Each answer is to be valued out of 10 marks.

Part-A

Choose the answer20 questions each 1 mark.

Part-B

Short Answers (300 words) 5 question each 5 marks.

Part-C

Essay questions (1000 words) 3 questions each 10 marks

VALUE ADDED COURSE

DEPARTMENT		COURSE CODE
ZOOLOGY	MUSHROOM CULTIVATION TECHNIQUES	VAZL01

OBJECTIVES

1. To emphasize the importance of integrating new knowledge of foods.

2. To update the technological innovations of edible mushrooms and improve the self employability.

UNIT – I : INTRODUCTION **(6 Hours)**
Introdution – Scope – Advantages- General Characters – Types of Mushrooms.

UNIT – II : IDENTIFICATION **(6 Hours)**
Identification of Edible and Poisonous Mushroom – Mushroom Poisoning.

UNIT – III : CULTURE TECHNIQUES **(6 Hours)**
Mushroom Culture – Type: Oyster Mushroom (*Pleurotus ostreatus*) – Spawn Production Techniques – Bed Preparation – Harvesting.

UNIT – IV : PROCESSING **(6 Hours)**
Preservation of Mushrooms – Value added mushroom products – Precaution of mushroom cultivation

UNIT – V : ECONOMIC VALUE **(6 Hours)**
Economic importance – Marketing and self employable aspects of mushroom cultivation-practical's

REFERENCES,

1. Kumarasan, V. 2001 : Biotechnology Saras Publication, Nagarcoil.
2. Dubey, R.C.2006 : A text book of Biotechnology, S. Chand & Co, India..
3. Suman, B.C. 2007: Mushroom production, Processing and uses agrobios, India.
4. Pathak, V.N. 2007: Mushroom production and processing Technology – Agrobios, India.
5. Sharma, V.P.2006: Diseases and pests of mushrooms Agrobios, India.

DEPARTMENT	VERMICOMPOSTING	CODE
ZOOLOGY		VAZL02

FOR UG STUDENTS

Unit I: INTRODUCTION **(6 Hours)**

Earthworm- structures, Geographical distribution, Classification based on habitat, (i) epigeics, (ii) anecics and (iii) endogeics.

Unit II: IDENTIFICATION **(6 Hours)**

i) Cocoon ii) Juvenile iii) Adult iv) Speciesv) Burrowingvi) Feeding vii) Casting.

Unit III: SPECIES SUITABLE FOR VERMICOMPOSTING **(6 Hours)**

Species Advocated for Vermicomposting, Species used in India

Unit IV: CONVENTIONAL STEPS INVOLVED IN VERMICOMPOSTING **(6 Hours)**

Steps of vermicomposting set up, Vermibed preparation, Management,

Unit V: VERMICAST **(6 Hours)**

Practical –and harvesting techniques of vermicast, Marketing of vermicompost.

REFERENCES:

1. S. Gajalakshmi, Indian Journal of Biotechnology Vol 3, October 2004, pp 486-494.

2. T. Ganeshkumar, Lambert Academic Publishing, 2013.

3. T. Ganeshkumar, Bioresources and Bioprocessing, 2014, 1:26.