

# **Holy Cross College (Autonomous), Nagercoil**

**Kanyakumari District, Tamil Nadu.**

**Accredited with A<sup>+</sup> by NAAC - IV cycle – CGPA 3.35**

Affiliated to

**Manonmaniam Sundaranar University, Tirunelveli**



**Semester I & II**

**Guidelines & Syllabus**

**DEPARTMENT OF ZOOLOGY**



**2023-2026**

**(With effect from the academic year 2023-2024)**

**Issued from**

**THE DEANS' OFFICE**

## **VISION**

Empower the students with Academic skills, Research aptitude and social commitment through holistic education.

## **MISSION**

1. Foster knowledge and skills through innovative teaching and instill moral and ethical values.
2. Render opportunities for critical thinking, communication, and collaboration.

3. Create research ambience to promote innovations and contemporary skills relevant to local and global needs.
4. Inspire to explore the natural resources and connect with nature.
5. Promote passion to serve the local community by creating empowered women of
6. Commitment and social consciousness through outreach and exposure programmes.
7. Facilitate life-long learning, participatory leadership, and commitment to society.

### **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

<b>POs</b>	<b>Upon completion of M.A./ M. Sc. /MSW Degree Programme, the graduates will be able to:</b>	<b>Mapping with Mission</b>
PEO1	apply scientific and computational technology to solve socio ecological issues and pursue research.	M1, M2
PEO2	continue to learn and advance their career in industry both in private and public sectors	M4 & M5
PEO3	develop leadership, teamwork, and professional abilities to become a more cultured and civilized person and to tackle the challenges in serving the country.	M2, M5 & M6

### **PROGRAMME OUTCOMES (POS)**

<b>PO</b>	<b>Upon completion of M.Sc. Degree Programme, the graduates will be able to:</b>	<b>Mapping with PEOs</b>
PO1	apply their knowledge, analyze complex problems, think independently, formulate and perform quality research.	<b>PEO1 &amp; PEO2</b>
PO2	carry out internship programmes and research projects to develop scientific and innovative ideas through effective communication.	<b>PEO1, PEO2 &amp; PEO3</b>
PO3	develop a multidisciplinary perspective and contribute to the knowledge capital of the globe.	<b>PEO 2</b>
PO4	develop innovative initiatives to sustain ecofriendly environment	<b>PEO1, PEO2</b>
PO5	pursue active career, team work and using managerial skills guide people to the right destination in a smooth and efficient way.	<b>PEO 2</b>
PO6	employ appropriate analysis tools and ICT in a range of learning scenarios, demonstrating the capacity to find, assess, and apply relevant information sources.	<b>PEO1, PEO2 &amp; PEO3</b>
PO7	learn independently for lifelong to execute professional, social and ethical responsibilities promoting sustainable development.	<b>PEO3</b>

### **PROGRAMME SPECIFIC OUTCOMES (PSOs)**

<b>PSO</b>	<b>Upon completion of M.Sc. Programme, the graduates will be able to:</b>	<b>PO addressed</b>
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PSO1	explain the various aspects of life sciences including Biochemistry, Cell and Molecular Biology, Biosystematics, Genetics, Evolution, Physiology, Developmental Biology, Exobiology, Immunology, Microbiology, Endocrinology, Bioinformatics, Biotechnology and Nanobiology.	PO1, PO2
PSO2	carryout experimental techniques, analyze statistically, draw conclusions, write report, present effectively and publish in indexed journals effectively	PO2, PO4, PO5, PO6
PSO 3	develop personal and key transferable skills and entrepreneurial skills through industrial / field visits and internships.	PO2, PO3
PSO 4	independently assemble facts, summarize and draw conclusions from scientific text and develop competence in the design and execution of research.	PO1, PO2, PO3, PO4, PO6
PSO 5	discriminate societal and environmental problems, adopt relevant technology, synthesis solution and claim for IPR	PO4, PO5, PO7

### Mapping of PO'S and PSO's

POs	PSO1	PSO 2	PSO3	PSO4	PSO5
PO1	M	S	M	S	M
PO2	M	S	S	S	S
PO3	S	M	M	S	S
PO4	S	S	S	S	S
PO5	M	S	S	S	S
PO6	S	S	M	S	S
PO7	S	S	S	S	S

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

### Eligibility

For Admission: A candidate who is a graduate of this college or any other recognized University in the main subject/subjects as given below against each or who has passed an examination accepted as equivalent by the Syndicate of Manonmaniam Sundaranar University, Tirunelveli, is eligible for admission.

**Duration of the Programme:** 2years

**Medium of Instruction:** English

### Passing Minimum

A minimum of 40% in the external examination and an aggregate of minimum 40% is required. There is no minimum pass mark for the continuous internal assessment.

### Components of M.Sc.Programme

Core Course	9x 100	900
Core Lab Course	3 x 100	300
Elective Course	6 x 100	600
Elective Lab Course	2x100	200
Core Project	1 x 100	100
<b>Total Marks</b>		<b>2100</b>

### Course Structure

#### Distribution of Hours and Credits

#### (i) Curricular Courses:

Course	SEMESTER	Total
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	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	<b>Hours</b>	<b>Credits</b>
Core– Theory	7 (5) + 7 (5) +	6 (5) + 6 (5) +	6 (5) + 6 (5) + 6 (5) + 6 (4)	6 (5) + 6 (5)	70	53
Core Lab course	4 (2)	4 (2)				
Elective Course	5 (3) + 5 (3)	4 (3) + 4 (3)	3 (3) -	4 (3) -	29	22
Elective Lab Course	2 (2)	2 (2)				
Core Project		-		10 (7)	10	7
Skill Enhancement Course		4 (2)	3 (2)	4 (2)	11	6
Internship/ Industrial Activity			(2)		-	2
Extension Activity				(1)	-	1
<b>Total</b>	<b>30 (20)</b>	<b>30 (22)</b>	<b>30 (26)</b>	<b>30 (23)</b>	<b>120</b>	<b>91</b>

**Total Number of Hours =120**

**(ii) Co-curricular Courses**

<b>Course</b>	<b>SEMESTER</b>				<b>Total Credits</b>
	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	
Life Skill Training –I	-	(1)	-	-	1
Life Skill Training –II	-	-	-	(1)	1
Field Project	(1)		-		1
Specific Value-Added Courses	(1)		(1)		2
Generic Value-Added Courses		(1)		(1)	2
MOOC		(1)		(1)	2
Community Engagement Activity (UBA)		(1)			1

**Total Number of Credits = 91 + (10)**

**Course Structure  
Semester-I**

<b>Course Code</b>	<b>Name of the Course</b>	<b>Credit</b>	<b>Hours</b>
ZP231CC1	Core Course - I : Structure and function of Invertebrates	5	7
ZP231CC2	Core Course - II: Comparative Anatomy of Vertebrates	5	7
ZP231CP1	Core Lab Course – I: Lab Course in Invertebrates & Vertebrates	2	4
ZP231EC1	Elective Course – I: a) Molecules and their interaction relevant	3	5

	to Biology		
ZP231EC2	Elective Course – I: b) Forensic Biology		
ZP231EC3	Elective Course – I: c) Wildlife Conservation and Management		
ZP231EC4	Elective Course – II: a) Biostatistics	3	5
ZP231EC5	Elective Course – II: b) Applied Zoology		
ZP231EC6	Elective Course – II: c) Pest Management		
ZP231EP1	Elective Lab Course -I: Molecules and their interaction relevant to Biology & Biostatistics	2	2
	<b>Total</b>	<b>20</b>	<b>30</b>

### Semester-II

Course Code	Title of the Course	Credits	Hours / Week
ZP232CC1	Core Course – III: Cellular and Molecular Biology	5	6
ZP232CC2	Core Course – IV: Developmental Biology	5	6
ZP232CP1	Core Lab Course – II: Lab Course in Cell Biology and Developmental Biology	2	4
ZP232EC1	Elective Course – III: a) Economic Entomology	3	4
ZP232EC2	Elective Course – III: b) Parasitology		
ZP232EC3	Elective Course – III: c) Agrochemicals & Pest management		
ZP232EC4	Elective Course – IV: a) Research methodology	3	4
ZP232EC5	Elective Course -IV: b) Apiculture		
ZP232EC6	Elective Course – IV: c) Sericulture		
ZP232EP1	Elective Lab Course – II: Economic Entomology & Research Methodology	2	2
ZP232SE1	Skill Enhancement Course I: Poultry Farming	2	4
	<b>Total</b>	<b>22</b>	<b>30</b>

### Specific Value-added Course

Semester	Code	Title of the Course	Credit
I & II	PG23LST1	Life Skill Training	1
II & IV	-	MOOC	1+1
II	PG232CE1	Community Engagement Course (CEC)	1
III & IV	PG23LST2	Life Skill Training	1
I	ZP231FP1	Field Project	1
I & III	ZP231V01 / ZP233V01	Specific Value-added Course	1+1

II & IV	PG232V01- PG232V12/ PG234V01- PG234V12	Generic Value-added Course	1+1
<b>Total</b>			<b>10</b>

S. No.	Course code	Title of the course	Total hours
I	ZP231V01	Basics of excel	30

### Examination Pattern

#### i) Core Course / Elective Course

Internal: External–25:75

Continuous Internal Assessment (CIA)

Internal Components and Distribution of Marks

Components	Marks
Internal test (2) (40 marks)	10
Quiz (2) (20 marks)	5
Seminar (10 marks)	5
Assignment: (Model Making, Exhibition, Role Play, Group Discussion, Problem Solving, Class Test, Open Book Test (Minimum three items per course) (30 marks)	5
<b>Total</b>	<b>25</b>

#### Question Pattern

Internal Test	Marks	External Exam	Marks
Part A 4 x 1 (No choice)	4	Part A 10 x 1 (No choice)	10
Part B 3 x 4 (Internal choice)	12	Part B 5 x 6 (Internal choice)	30
Part C 3 x 8 (Internal choice)	24	Part C 5 x 12 (Internal choice)	60
<b>Total</b>	<b>40</b>	<b>Total</b>	<b>100</b>

#### ii) Lab Course:

Ratio of Internal and External= 25:75

Total: 100 marks

#### Internal Components and Distribution of Marks

Internal Components	Marks
Performance of the Experiments	10

Regularity in attending practical and submission of records	5
Record	5
Model exam	5
<b>Total</b>	<b>25</b>

### Question pattern

External Exam	Marks
Major Practical	75
Minor Practical / Spotters /Record	
<b>Total</b>	<b>75</b>

### iii) Skill Enhancement Course

Ratio of Internal and External = **25: 75**

#### Internal Components and Distribution of Marks

Components	Marks
Internal test (2)	10
Quiz (2)	5
Assignment: (Model Making, Exhibition, Role Play, Album, Group Activity (Mime, Skit, Song) (Minimum three items per course)	10
<b>Total</b>	<b>25</b>

#### Question Pattern

Internal Test	Marks	External Exam	Marks
Part A 2 x 2 (No Choice)	4	Part A 5 x 2 (No Choice)	10
Part B 3 x 4 (Open choice <b>Three</b> out of <b>Five</b> )	12	Part B 5 x 5 (Open choice any <b>Five</b> out of <b>Eight</b> )	25
Part C 1 x 9 (Open choice <b>One</b> out of <b>Three</b> )	9	Part C 5 x 8 (Open choice any <b>Five</b> out of <b>Eight</b> )	40
<b>Total</b>	<b>25</b>	<b>Total</b>	<b>75</b>

### iv) Internship/ Industrial Activity

Components	Marks
Industry Contribution	50
Report & Viva-voce	50

### v) Project:

Ratio of Internal and External 25 : 75

Internal (Supervisor)	Marks
I Review	5
II Review	5
Report	15

<b>External (External Examiner)</b>	
Report	40
Viva-voce (individual, open viva-voce)	35
<b>Total</b>	<b>100</b>

**Co-Curricular Courses:**

**(i) Life Skill Training**

**Internal Component**

<b>Components</b>		<b>Marks</b>
<b>Life Skill Training -I</b>	Album (20 pages)	30
	Group Song, Mime, Skit (Group of 5students)	20
	<b>Total</b>	<b>50</b>
<b>Life Skill Training -II</b>	Case Study (30 pages)	50
	<b>Total</b>	<b>50</b>

**External Component**

<b>Written Test</b>	Five out of Seven (5 x 10)	50
	<b>Total</b>	<b>50</b>

**(ii) Field Project:**

<b>Components</b>	<b>Marks</b>
Field Work	50
Report & Viva-voce	50

**(iii) Specific Value-Added Courses & Generic Value-Added Courses:**

<b>Components</b>	<b>Marks</b>
Internal	25
External	75

**(iv) Community Engagement Activity-UBA**

<b>Internal Component</b>	
<b>Component</b>	<b>Marks</b>
Attendance (Field Work)	30
Participation	20
<b>Total</b>	<b>50</b>

**External Component**

<b>Component</b>	<b>Marks</b>
Group Project Report/ Case Study (10-15 pages in print)	50
<b>Total</b>	<b>50</b>

**Outcome Based Education**

**(i) Knowledge levels for assessment of Outcomes based on Blooms Taxonomy**



S. No	Level	Parameter	Description
1	K1	Knowledge/Remembering	It is the ability to remember the previously learned
2	K2	Comprehension/Understanding	The learner explains ideas or concepts
3	K3	Application/Applying	The learner uses information in a new way
4	K4	Analysis/Analysing	The learner distinguishes among different parts
5	K5	Evaluation/Evaluating	The learner justifies a stand or decision
6	K6	Synthesis /Creating	The learner creates a new product or point of view

**(ii) Weightage of K – levels in Question Paper**

**Number of questions for each cognitive level:**

Assessment	Cognitive Level	K1			K2			K3			K4, K5, K6			Total
		A	B	C	A	B	C	A	B	C	A	B	C	
Internal Test	Part	A	B	C	A	B	C	A	B	C	A	B	C	
	No. Of Questions	1	1			1		1		1	2	1	2	10
External Examination	Part	A	B	C	A	B	C	A	B	C	A	B	C	
	No. Of Questions	3	-	1	3	1	1	1	2	1	3	2	2	20

**Evaluation**

- The performance of a student in each Course is evaluated in terms of percentage of marks with a provision for conversion to grade points.
- Evaluation for each Course shall be done by a Continuous Internal Assessment (CIA) by the Course teacher as well as by an end semester examination and will be consolidated at the end of the semester.
- There shall be examinations at the end of each semester, for odd semesters in October/November; for even semesters in April / May.
- A candidate who does not pass the examination in any course (s) shall be permitted to re-appear in such failed course (s) in the subsequent examination to be held in October / November or April / May. However, candidates who have arrears in Practical Examination(s) shall be permitted to re-appear for their arrears only along with Regular Practical examinations in the respective semester.
- Viva- voce: Each candidate shall be required to appear for Viva-voce Examination in defense of the Project.
- The results of all the examinations will be published in the College website.

**Conferment of the Master's Degree**

A candidate shall be eligible for the conferment of the Degree of Master of Arts / Science / Commerce only if the minimum required credits for the programme thereof (91 +10 credits) is earned.

**Grading System**

**For a semester examination:**

**Calculation of Grade Point Average for End Semester Examination:**

$$\text{GPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the course}}{\text{Sum of the credits of the courses (passed) in a semester}}$$

**For the entire programme:**

$$\text{Cumulative Grade Point Average (CGPA)} = \frac{\sum_n \sum_i C_{ni} G_{ni}}{\sum_{ni} \sum_i C_{ni}}$$

CGPA =  $\frac{\text{Sum of the multiplication of grade points by the credits of the entire programme}}{\text{Sum of the credits of the courses of the entire programme}}$

Where

$C_i$  - Credits earned for course i in any semester

$G_i$  - Grade point obtained for course i in any semester

n - semester in which such courses were credited

### Final Result

#### Conversion of Marks to Grade Points and Letter Grade

Range of Marks	Grade Points	Letter Grade	Description
90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5-7.9	D	Distinction
70-74	7.0-7.4	A+	Very Good
60-69	6.0-6.9	A	Good
50-59	5.0-5.9	B	Average
00-49	0.0	U	Re-Appear
ABSENT	0.0	AAA	ABSENT

#### Overall Performance

CGPA	Grade	Classification of Final Results
9.5-10.0	O+	First Class – Exemplary*
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D++	
8.0 and above but below 8.5	D+	First Class with Distinction*
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
0.0 and above but below 5.0	U	Re-appear

\*The candidates who have passed in the first appearance and within the prescribed semester are eligible.

## SEMESTER I

### CORE COURSE I: STRUCTURE AND FUNCTION OF INVERTEBRATES

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP231CC1	5	1	-	1	4	7	105	25	75	100

#### Pre-requisite:

Students should know the taxonomical classification of invertebrates in relation to their functional morphology.

#### Learning Objectives:

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

#### Course Outcomes

On the successful completion of the course, student will be able to:		
<b>CO1</b>	remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.	<b>K1</b>
<b>CO2</b>	understand the evolutionary process. All are linked in a sequence of life pattern	<b>K2</b>
<b>CO3</b>	apply this for pre-professional work in agriculture and conservation of life forms.	<b>K3</b>
<b>CO4</b>	analyze what lies beyond our present knowledge of life process.	<b>K4</b>
<b>CO5</b>	evaluate and to create the perfect phylogenetic relationship in classification.	<b>K5</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Units	Contents	No. of Hours
I	structure and function in invertebrates: Principles of Animal taxonomy; Species concept; International code of zoological nomenclature; Taxonomic procedures; New trends in taxonomy	<b>21</b>
II	organization of coelom: Acoelomates; Pseudocoelomates; Coelomates: Protostomia and Deuterostomes; Locomotion: Flagella and ciliary movement in Protozoa; Hydrostatic movement in Coelenterata, Annelida and Echinodermata	<b>21</b>
III	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	<b>21</b>
IV	excretion: Organs of excretion: coelom, coelomoducts, Nephridia and Malpighian tubules; Mechanisms of excretion; Excretion and osmoregulation. Nervous system: Primitive nervous system: Coelenterata and Echinodermata; Advanced nervous system: Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda); Trends in neural evolution	<b>21</b>
V	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	<b>21</b>

**Text Books:**

1. Ekambaranatha Iyer, 2000. A Manual of Zoology, 10<sup>th</sup> edition, Viswanathan, S., Printers & Publishers Pvt Ltd.
2. Barrington, E. J.W. 1979. Invertebrate Structure and Function. The English Language Book Society and Nelson, pp-765.
3. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.

**Reference Books:**

1. Barnes, R. D. 1974. Invertebrate Zoology, (Second Edition), Holt-Saunders International Edition, pp-1024.
2. Barnes, R. S. K., P. Calow, P. J. W. Olive, D. W. Golding, J. J. Spicer. 2013. The Invertebrates: A Synthesis. Third Edition. John Wiles & Sons Inc., Hoboken. New Jersey, New Delhi.
3. Dechenik, J. A. 2015. Biology of Invertebrates (Seventh Edition). Published by McGraw Hill Education (India) Private Limited, pp-624.

**Web Resources**

1. <https://www.uou.ac.in/sites/default/files/slm/MSCZO-501.pdf>
2. <https://manoa.hawaii.edu/exploringourfluidearth/biological/invertebrates/structure-and-function>
3. <https://www.zoologytalks.com/category/structure-and-functions-of-invertebrates/>
4. <https://www.bilasagirlscollege.ac.in/newsData/D54.pdf>

**MAPPING WITH PROGRAMME OUTCOMES**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	3	3	3	2
CO2	3	3	2	2	3	3	2
CO3	3	2	3	2	3	3	2
CO4	3	2	3	2	3	3	2
CO5	3	2	3	2	3	3	2
<b>TOTAL</b>	15	12	13	11	13	11	10
<b>AVERAGE</b>	3	2.4	2.6	2.2	2.6	2.2	2

**3 – Strong, 2- Medium, 1- Low**

**MAPPING WITH PROGRAMME SPECIFIC OUTCOMES**

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	3	3	2	3	3
CO3	2	2	3	3	2
CO4	3	3	3	3	3
CO 5	2	2	2	2	2
<b>Total</b>	13	13	12	14	12
<b>Average</b>	2.6	2.6	2.4	2.8	2.4

**SEMESTER – I**  
**CORE COURSE II: COMPARATIVE ANATOMY OF VERTEBRATES**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP231CC2	5	1	-	1	5	7	105	25	75	100

**Pre-requisite:**

Students with knowledge and comprehension on zoology

**Learning Objectives:**

1. To impart conceptual knowledge about the animal life in the air and their behaviours.
2. To understanding the origin and efficiency of mammals and evolutionary changes that occurred in the life of vertebrates.

**Course Outcomes:**

On successful completion of the course, the student will be able to:		
<b>CO1</b>	remember the general concepts and major groups in animal classification, origin, structure, functions, and distribution of life in all its forms.	<b>K1</b>
<b>CO2</b>	understand the evolutionary process. All are linked in a sequence of life patterns.	<b>K2</b>
<b>CO3</b>	apply this for pre-professional work in agriculture and conservation of life forms.	<b>K3</b>
<b>CO4</b>	analyze what lies beyond our present knowledge of life process.	<b>K4</b>
<b>CO5</b>	evaluate and to create the perfect phylogenetic relationship in classification.	<b>K5</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit	Contents	Hours
<b>I</b>	<b>Origin of vertebrates:</b> Concept of Protochordata; The nature of vertebrate morphology; Definition, scope and relation to other disciplines; Importance of the study of vertebrate morphology.	21
<b>II</b>	<b>Origin and classification of vertebrates:</b> Vertebrate integument and its derivatives. Development, general structure and functions of skin and its derivatives; Glands, scales, horns, claws, nails, hoofs, feathers and hairs.	21
<b>III</b>	<b>General plan of circulation in various groups:</b> 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	21
<b>IV</b>	<b>Skeletal system:</b> Form, function, body size and skeletal elements of the body; Comparative account of jaw suspensorium, Vertebral column; Limbs and girdles; Evolution of Urinogenital system in vertebrate series.	21
<b>V</b>	<b>Sense organs:</b> Simple receptors; Organs of Olfaction and taste; Lateral line system; Electoreception. Nervous system: Comparative anatomy of the brain in relation to its functions; Comparative anatomy of spinal cord; Nerves-Cranial, Peripheral and Autonomous nervous systems.	21
<b>Self-Study</b>	Scope and relation of vertebrate morphology to other disciplines, Vertebrate integument and its derivatives, Evolution of aortic arches and portal systems, Comparative account of jaw suspensorium, Comparative anatomy of spinal cord	

**Text Books:**

1. Yong, J. Z. 1981. The life of Vertebrates, English language Book society, London, pp-645.
2. Romer, A.S. 1971. The Vertebrate body, W.B.S. Saunders, Philadelphia, pp-600.
3. Ayyar, E.K. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol. II (Chordata), S.

Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p.

- Jordan, E.K. and P.S. Verma, 1995. Chordate Zoology and Elements of Animal Physiology, 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi, 1151 pp.
- Ganguly, Sinha, Bharati Goswami and Adhikari, 2004. Biology of animals Vol.II - New central book Agency (p) Ltd.

**Reference Books:**

- Waterman, A.J. 1972. Chordate Structure and Function, MacMillan Co., New York, pp.587.
- Parker T. J. and W. A. Haswell. 1962. A text book of Zoology, Vol. 2, Vertebrates, 7th Edition, Mac Millan Press, London, pp-750.
- Ekambaranatha Ayyar and T. N. Ananthakrishnan. 2009. Manual of Zoology, Vol – II, S. Viswanathan Pvt. Ltd. Chennai.
- Kotpal, 2019. R.L. Modern Text Book of Zoology Vertebrates, 4th Edition, Rastogi Publications, Meerut, pp-968.

**Web sources:**

- Swayam Prabha: <https://www.swayamprabha.gov.in/index.php/program/archive/9>
- <https://bit.ly/3Av1Ejg/>
- <https://bit.ly/3kqTfYz/>
- <https://biologyeducare.com/aves/>
- <https://www.vedantu.com/biology/mammalia/>

**MAPPING WITH PROGRAMME OUTCOMES**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	3	2	3	2
CO2	3	1	1	3	2	3	2
CO3	3	2	1	2	2	2	2
CO4	3	1	1	3	1	3	2
CO5	3	2	1	2	3	3	2
<b>Total</b>	15	8	5	13	10	14	10
<b>Average</b>	3	1.6	1	2.6	2	2.8	2

\*3 - Strong; 2 - Medium; 1 - Low

**MAPPING WITH PROGRAMME SPECIFIC OUTCOMES**

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	3	3	2	2	3
CO3	2	2	3	2	2
CO4	3	3	3	3	3
CO 5	2	3	2	2	2
<b>Total</b>	13	14	12	12	12
<b>Average</b>	2.6	2.8	2.4	2.4	2.4

## SEMESTER I

### CORE LAB COURSE I: LAB COURSE IN INVERTEBRATES & VERTEBRATES

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP231CP1	-	-	4		3	4	60	25	75	100

#### Pre-requisite

Basic knowledge on the animals living in different habitats

#### Learning Objectives:

1. Understanding the salient features and functional anatomy of different systems and the skeletal system in invertebrates & vertebrates.
2. Developing the skill in mounting techniques of the biological samples.

#### Course Outcomes

On the successful completion of the course, student will be able to:		
<b>CO1</b>	understand the structure and functions of various systems in animals	<b>K1</b>
<b>CO2</b>	learn the adaptive features of different groups of animals	<b>K2</b>
<b>CO3</b>	learn the mounting techniques	<b>K3</b>
<b>CO4</b>	acquire strong knowledge on the animal skeletal system	<b>K4</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

<b>INVERTEBRATES</b>
<b>Dissection</b>
Earthworm : Nervous system <i>Pila</i> : Digestive and nervous systems <i>Sepia</i> : Nervous system Cockroach : Nervous system Grasshopper : Digestive system and mouth parts Prawn : Appendages, nervous and digestive systems Crab : Nervous system
<b>Study of the following slides with special reference to their salient features and their modes of life</b>
<ol style="list-style-type: none"> <li>1. <i>Amoeba</i></li> <li>2. <i>Entamoeba histolytica</i></li> <li>3. <i>Paramecium</i></li> <li>4. <i>Hydra</i> with bud</li> <li>5. Sporocyst – Liver fluke</li> <li>6. <i>Cercaria</i> larva</li> <li>7. <i>Tape worm (Scolex)</i></li> <li>8. <i>Ascaris</i> T. S.</li> <li>9. Mysis of prawn</li> </ol>
<b>Spotters</b>
<ol style="list-style-type: none"> <li>1. Scorpion</li> <li>2. <i>Panaeus indicus</i></li> <li>3. <i>Emerita (Hippra)</i></li> <li>4. <i>Perna viridis</i></li> </ol>

<b>Mounting</b>	
Earthworm	: Body setae
<i>Pila</i>	: Radula
Cockroach	: Mouth parts
Grasshopper	: Mouth parts

<b>VERTEBRATES</b>	
<b>Study the nervous system of Indian dog shark - Dissection</b>	
<ol style="list-style-type: none"> <li>1. Nervous system of <i>Scoliodon laticaudatus</i> – 5<sup>th</sup> or Trigeminal nerve</li> <li>2. Nervous system of <i>Scoliodon laticaudatus</i> – 7<sup>th</sup> or Facial nerve</li> <li>3. Nervous system of <i>Scoliodon laticaudatus</i> – 9<sup>th</sup> and 10<sup>th</sup> or Glossopharyngeal &amp; Vagus nerve</li> </ol>	
<b>Study of the following specimens with special reference to their salient features and their modes of life</b>	
<ol style="list-style-type: none"> <li>1. <i>Amphioxus</i> sp. (Lancelet)</li> <li>2. <i>Ascidia</i> sp. (sea squirt)</li> <li>3. <i>Scoliodon laticaudatus</i> (Indian dog shark)</li> <li>4. <i>Trygon</i> sp. (Sting ray)</li> <li>5. <i>Torpedo</i> sp. (Electric ray)</li> <li>6. <i>Arius maculatus</i> (Cat fish)</li> <li>7. <i>Belone cancila</i> (Flute fish)</li> <li>8. <i>Exocoetus poecilopterus</i> (Flying fish)</li> <li>9. <i>Mugil cephalus</i> (Mullet)</li> <li>10. <i>Tilapia mossambicus</i> (Tilapia)</li> <li>11. <i>Rachycentron canadum</i> (Cobia)</li> <li>12. <i>Tetrodon punctatus</i> (Puffer fish)</li> <li>13. <i>Dendrophis</i> sp. (Tree snake)</li> </ol>	
<b>Study of the different types of scales in fishes</b>	
<ol style="list-style-type: none"> <li>1. Cycloid scale</li> <li>2. Ctenoid scale</li> <li>3. Placoid scale</li> </ol>	
<b>Study of the frog skeleton system (Representative samples)</b>	
<ol style="list-style-type: none"> <li>1. Entire skeleton</li> <li>2. Skull</li> <li>3. Hyoid apparatus</li> <li>4. Pectoral girdle and sternum</li> <li>5. Pelvic girdle</li> <li>6. Fore limb</li> <li>7. Hind limb</li> </ol>	
<b>Mounting</b>	
<ol style="list-style-type: none"> <li>1. Weberian ossicles of fish</li> </ol>	

**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. Chatterjee, P. Chattopadhyaya. 2011. Advanced Practical Zoology, Arunabha Sen Publishers, pp-1070.



**Web Resources:**

1. <http://www.csrtimys.res.in/>
2. <http://csb.gov.in/>
3. <https://iinrg.icar.gov.in/>
4. <https://www.nationalgeographic.com/animals/invertebrates/>
5. [https://www.youtube.com/watch?v=b04hc\\_kOY10](https://www.youtube.com/watch?v=b04hc_kOY10)
6. <https://bit.ly/3CzTEy8>
7. <http://tolweb.org/Chordata/2499>
8. <https://www.nhm.ac.uk/>

**MAPPING WITH PROGRAMME OUTCOMES**

<b>Cos</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>
<b>CO1</b>	3	2	3	3	2	3	2	2
<b>CO2</b>	3	2	3	3	3	2	2	2
<b>CO3</b>	3	2	3	3	3	2	2	2
<b>CO4</b>	3	2	3	3	2	2	2	2
<b>TOTAL</b>	12	6	12	12	10	9	8	8
<b>AVERAGE</b>	3	1.5	3	3	2.5	2.25	2	2

3 – Strong, 2- Medium, 1- Low

**MAPPING WITH PROGRAMME SPECIFIC OUTCOMES**

<b>COs</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	2	3	3
<b>CO2</b>	3	3	2	2	3
<b>CO3</b>	2	2	3	2	2
<b>CO4</b>	3	3	3	3	3
<b>Total</b>	11	11	10	10	11
<b>Average</b>	2.75	2.75	2.5	2.5	2.75

**SEMESTER I**  
**ELECTIVE COURSE - I**  
**(a) MOLECULES AND THEIR INTERACTION RELEVANT TO BIOLOGY**

Course Code	L	T	P	S	Credits	Inst. Hours	Total hrs	Marks		
								CIA	External	Total
ZP231EC1	3	1	-	1	3	5	75	25	75	100

**Pre-requisite:**

Understanding fundamental properties of elements, atoms, molecules, chemical bonds, linkages and structure, composition, metabolism, and functions of biomolecules.

**Learning Objectives**

1. Students should know the fundamentals of biochemistry.
2. To develop analytical and communicative skills to conduct experiments and interpret the results

**Course Outcome**

On the successful completion of the course, student will be able to:		
<b>CO1</b>	learn the structure, properties, metabolism, and bioenergetics of biomolecules	<b>K1</b>
<b>CO2</b>	acquire knowledge on various classes and major types of enzymes, classification, their mechanism of action and regulation	<b>K2</b>
<b>CO3</b>	understand the fundamentals of biophysical chemistry and biochemistry, importance, and applications of methods in conforming the structure of biopolymers	<b>K3</b>
<b>CO4</b>	comprehend the structural organization of and proteins, carbohydrates, nucleic acids and lipids	<b>K4</b>
<b>CO5</b>	familiarize the use of methods for the identification, characterization, and conformation of biopolymer structures	<b>K5</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Units	Contents	No. of Hours
<b>I</b>	Basics of biophysical chemistry and biochemistry: Structure of atoms, molecules, and chemical bonds - Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).	15
<b>II</b>	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).	15
<b>III</b>	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	15
<b>IV</b>	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).	15
<b>V</b>	Stabilizing interactions in biomolecules: Stability of protein and nucleic acid structures - hydrogen bonding, covalent bonding, hydrophobic interactions and disulfide linkage.	15

<b>Self-study</b>	Structure of atoms, Hydrophobic inter actions, Glycolysis t-RNA, Nucleic acid structures
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### 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. (7<sup>th</sup> 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

### References

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.

### Web Resources:

1. <http://biochemical-pathways.com/#/map/1>
2. <https://www.ebi.ac.uk/chembl/>
3. <http://www.iubmb-nicholson.org/chart.html>
4. <https://www.sigmaaldrich.com/IN/en/search/enzymes?focus=products&page=1&perpage=30&sort=relevance&term=enzymes&type=product>

### MAPPING WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO 1</b>	3	3	1	2	3	1	3
<b>CO 2</b>	3	2	2	2	2	1	3
<b>CO 3</b>	3	3	2	2	3	2	3
<b>CO 4</b>	3	2	1	1	3	2	2
<b>CO5</b>	2	2	3	3	2	3	3
<b>Total</b>	14	12	9	10	13	9	14
<b>Average</b>	2.8	2.4	1.8	2	2.6	1.8	2.8

3 – Strong, 2 – Medium, 1 - Low

### MAPPING WITH PROGRAMME SPECIFIC OUTCOMES

COs	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	2	3	3
<b>CO2</b>	3	3	2	2	3
<b>CO3</b>	2	2	3	2	2
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	2	2	3	3
<b>Total</b>	14	13	13	13	14
<b>Average</b>	2.8	2.6	2.6	2.6	2.8

**SEMESTER I**  
**ELECTIVE COURSE - I (b) FORENSIC BIOLOGY**

Course Code	L	T	P	S	Credits	Inst. Hours	Total hrs	Marks		
								CIA	External	Total
ZP231EC2	3	1	-	1	3	5	75	25	75	100

**Pre-requisite:**

Students should know the fundamentals of natural science and have a curiosity of criminology.

**Learning Objectives:**

1. Students should emphasize the importance of scientific methods in crime detection and disseminate information on the advancements in the field of forensic science.
2. Derive to skills to identify crime through various forensic techniques

**Course Outcomes**

On the successful completion of the course, student will be able to		
<b>CO1</b>	recall the fundamentals of forensic biology, psychology, and criminal profiling.	<b>K1</b>
<b>CO2</b>	outline the use of scientific evidence in a legal context using basic facts, fundamental principles, and functions of forensic science.	<b>K2</b>
<b>CO3</b>	apply the knowledge gained on forensic, dermatoglyphic, serological and odonatological techniques to render forensic service during real-time crime scenes.	<b>K3</b>
<b>CO4</b>	analyze fingerprints, personal identification evidence, bite marks and pug marks.	<b>K4</b>
<b>CO5</b>	evaluate information to find strategies to resolve problems in forensic biology.	<b>K5</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Units	Contents	No. of Hours
<b>I</b>	Concepts and scope, functions, and historical aspects of forensic science. Importance, nature, location, collection and preservation of biological exhibits and crime scene investigation of biological evidence. Forensic dermatoglyphics - biological basis of fingerprints, formation of ridges, fundamental principles of fingerprinting, types of fingerprints, fingerprint patterns, automated fingerprint identification system.	15
<b>II</b>	Forensic examination of hair - importance, nature, location, structure, growth phases of hair, collection, evaluation, and tests for their identification. Forensic Serology - identification of body fluids, collection and preservation of blood evidence, distinction between human and non-human blood, semen - forensic significance of semen, composition and morphology of spermatozoa, collection, evaluation and tests for identification of semen. Composition and forensic significance of saliva, sweat, milk and urine.	15
<b>III</b>	Structural variation, types of teeth - human and non-human teeth, determination of age from teeth, eruption sequence, dental anomalies, their significance in personal identification. Bite marks - forensic significance, collection and preservation of bite marks, photography and evaluation of bite marks, lip prints in forensic investigations.	15
<b>IV</b>	Forensic Entomology - insects of forensic importance, collection of entomological evidence during death investigations. The role of aquatic insects in forensic investigations, insect succession on carrion and its relationship to determine time since death, factors influencing insect succession on carrion, its application to forensic	15

	entomology. Forensic Microbiology - types and identification of microbial organisms of forensic significance.	
V	Importance of Wildlife Protection Act-1972- Schedules in the protection of endangered species of flora and fauna. Identification of wildlife materials such as skin, fur, bones, nails, horn, teeth, plants, plant parts and products by conventional and modern methods. Identification of pug marks of various animals, DNA techniques in wildlife investigations.	15

<b>Self-study</b>	Historical aspects of fingerprints, Collection, and preservation of blood Types of teeth, Forensic microbiology, DNA techniques
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#### Text Books:

1. S. Chowdhuri (1971). *Forensic Biology*. New Delhi: BPRD.
2. R. Saferstein (1993). *Forensic Science Handbook* (Vol. 3). New Jersey: Prentice Hall.

#### References

1. R.S. Ramotowski (2013). Lee and Gaenslen's, *Advances in Fingerprint Technology* (3rd ed.). Boca Raton: CRC Press.
2. L. Stryer, (1988). *Biochemistry* (3rd ed.). New York: W.H. Freeman and Company.
3. R.K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, (1993). *Harper's Biochemistry*. Norwalk: APPLETON and Lange.
4. M. Bernstein (1997). Forensic odontology in, *Introduction to Forensic Sciences* (2nd ed.), W.G. Eckert (Editor). Boca Raton: CRC Press.
5. J. Dix (1999). *Handbook for Death Scene Investigations*. Boca Raton: CRC Press.
6. V.J. Geberth, (2006). *Practical Homicide Investigation*. Boca Raton CRC Press.
7. W.G. Eckert and S.H. James (1989). *Interpretation of Bloodstain Evidence at Crime Scenes*. Boca Raton: CRC Press.
8. G.T. Duncan and M.I. Tracey (1997). Serology and DNA typing in, *Introduction to Forensic Sciences* (2nd ed.), W.G. Eckert (Editor.). Boca Raton: CRC Press.

#### Web Resources:

1. <http://www.dnaftb.org/>
2. <https://forensicdental.wordpress.com/>
3. <https://www.forensicsciencesimplified.org/>
4. <http://www.istl.org/03-spring/internet.html>

#### MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	3	1	2	3	1	3
CO 2	3	2	2	2	2	1	3
CO 3	3	3	2	2	3	2	3
CO 4	3	2	1	1	3	2	2
CO5	2	2	3	3	2	3	3
<b>Total</b>	14	12	9	10	13	9	14
<b>Average</b>	2.8	2.4	1.8	2	2.6	1.8	2.8

3 – Strong, 2 – Medium, 1 - Low

**MAPPING WITH PROGRAMME SPECIFIC OUTCOMES**

<b>COs</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	2	3	2	2	3
<b>CO3</b>	2	2	3	2	2
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	2	2	3	3
<b>Total</b>	13	13	13	13	14
<b>Average</b>	2.8	2.6	2.6	2.6	2.8

**SEMESTER: I**  
**ELECTIVE COURSE - I**  
**(c) WILDLIFE CONSERVATION AND MANAGEMENT**

Course Code	L	T	P	S	Credits	Inst. Hours	Total hrs	Marks		
								CIA	External	Total
ZP231EC3	3	1	-	1	3	5	75	25	75	100

**Pre-requisite:**

Students should know the importance of wild-life and be responsible to conserve the environment and the ecosystem.

**Learning Objectives**

1. To equip students with adequate knowledge of various biodiversity monitoring methodologies, conservation, and management
2. To identify the issues of vertebrate pests, wildlife conflict and over abundant species, wildlife health and diseases.

**Course Outcomes**

On the successful completion of the course, student will be able to:		
<b>CO1</b>	develop the ability to use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues	<b>K1</b>
<b>CO2</b>	develop the ability to work collaboratively on team-based projects	<b>K2</b>
<b>CO3</b>	demonstrate proficiency in the writing, speaking, and critical thinking skills needed to become a wildlife technician	<b>K3</b>
<b>CO4</b>	gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management	<b>K4</b>
<b>CO5</b>	develop an ability to analyze, present and interpret wildlife conservation management information.	<b>K5</b>

Units	Contents	No. of Hours
<b>I</b>	Definition and importance of wildlife; Types of ecosystems. Causes of depletion of wildlife; Classification of wetland and animal inhabitants; Population vulnerability analysis and its components; Factors responsible for the extinction of animals; Types of protected areas and the concept of zoning within the protected areas.	15
<b>II</b>	Wildlife Sanctuaries and National Parks in India: Theories of population dispersal; Animal movement, concept of home range and territory; Tracking movement by remote sensing and GIS. Wildlife conservation, ethics and importance of conservation; Impact of habitat destruction and fragmentation on wildlife; Biological parameters such as food, cover, forage and their impact on wild life;	15
<b>III</b>	Population attributes; concepts of exponential and logistic growth rates of wildlife; Density dependent and independent population regulation; Impact of introduced species on preexisting flora and fauna of wildlife; Identification and estimation of wild animals by fecal sample analysis, hair identification, pug marks and census methods. Predator-prey models and impact of predation.	15
<b>IV</b>	Wildlife conservation objectives- Captive breeding techniques and translocation and reintroduction; Inviolate area and critical habitats and their impact on wildlife; Different terrestrial habitats of wildlife in India; Restoration of degraded habitat. Damage caused by wildlife in India and its mitigation; Sick animal refuges in protected areas. Type of wildlife management-manipulative, custodial; Management of over abundant wild animal populations causing damages to nearby inhabitants and their crops and animals;	15

<b>V</b>	Tools and techniques to control the menace of wild animals; man, wildlife conflict resolution and mitigation; Management of exotic and invasive wetland species in India. Habitat manipulation– control and regulation of grazing. Weed eradication; Major diseases of domestic and wild animals and their control and impact of wild life tourism.	15
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<b>Self-study</b>	Types of ecosystems, Wild life sanctuaries and national parks in India, Wild life conservation, Weed eradication
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### Text Books

1. Caughley, G., and Sinclair, A.R.E. (1994) *Wildlife Ecology and Management*. Blackwell Science.
2. Goutam Kumar Saha & Subhendu Mazumdar (2017). *Wildlife Biology: An Indian Perspective*. New Delhi: PHI Learning Pvt. Ltd.
3. Singh, S.K (2015). *Textbook of wildlife management (2<sup>nd</sup> ed.)*. Delhi: CBS Publishers and Distributors Pvt. Ltd.

### Reference Books

1. Woodroffe, R., Thirgood, S. and Rabinowitz, A. (2005) *People and Wildlife, Conflict or Co-existence?* Cambridge University.
2. Bookhout, T.A. (1996) *Research and Management Techniques for Wildlife and Habitats (5<sup>th</sup> edition)* The Wildlife Society, Allen Press.
3. Sutherland, W.J. (2000) *The Conservation Handbook: Research, Management and Policy*. Blackwell Sciences
4. Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008) *Problem solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory*. Blackwell Publishing.
5. Taj Rawat (2012). *Biodiversity Conservation and Wildlife Tourism*. Delhi: Discovery Publishing House Pvt. Ltd.
6. Kumar, U. & Asija, M.J. (2007). *Biodiversity - Principle and Conservation (2<sup>nd</sup> ed.)*. Jodhpur Student Editors.
7. Seshadiri Balakrishnan, (1969). *The Twilight of India's Wildlife*. Chennai: Oxford University Press.
8. Gee, E.P. (1969). *Wildlife in India (1<sup>st</sup>ed.)*. London: Collins Foundation Books.
9. Anthony R.E. Sinclair, John M. Fryxell & Graeme Caughley (2006). *Wildlife Ecology, Conservation, and Management (2<sup>nd</sup> ed.)*. USA: Blackwell Publishing.

### Web Sources

1. <https://education.nationalgeographic.org/resource/wildlife-conservation/>
2. <https://www.clearias.com/wildlife-conservation-projects/>
3. <https://www.wii.gov.in/>
4. <https://www.mdpi.com/2673-7159/1/2/9>

### MAPPING WITH PROGRAMME OUTCOMES

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO1</b>	3	2	3	3	3	2	2
<b>CO2</b>	3	2	3	3	3	2	2
<b>CO3</b>	3	2	3	3	3	2	2
<b>CO4</b>	3	2	3	3	3	2	2
<b>CO5</b>	3	2	3	3	3	2	2
<b>TOTAL</b>	15	10	15	15	15	10	10
<b>AVERAGE</b>	3	2	3	3	3	2	2

**3 – Strong, 2- Medium, 1- Low**



**MAPPING WITH PROGRAMME SPECIFIC OUTCOMES**

<b>COs</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	2	3	2	2	3
<b>CO3</b>	2	2	3	2	2
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	2	2	3	3
<b>Total</b>	13	13	13	13	14
<b>Average</b>	2.8	2.6	2.6	2.6	2.8

**SEMESTER I**  
**ELECTIVE COURSE – II a) BIostatISTICS**

Course Code	L	T	P	S	Credits	Inst. Hours	Total hrs	Marks		
								CIA	External	Total
ZP231EC4	3	1	-	1	3	5	75	25	75	100

**Pre-requisite:**

Students should be aware of the importance of analysis of quantitative and qualitative information from biological studies

**Learning Objectives:**

The main objectives of this course are:

1. To enable the students to understand the basic concepts in Biostatistics and analyse the data to derive inferences in various biological experiments.
2. To develop analytical skills of statistics and draw valid conclusions in research.

**Course outcomes**

COs	Upon completion of this course the students will be able to:	CL
CO1	recall different biological data, methods of collection and analysis of data.	K1
CO2	comprehend the design and application of biostatistics relevant to experimental and population studies.	K2
CO3	acquire skills to perform various statistical analyses using modern statistical techniques and software.	K3
CO4	analyze the data and interpret the results manually or by using software	K4
CO5	evaluate on the merits and limitation of practical problems in biological/ health management study as well as to propose and implement appropriate statistical design/ methods of analysis.	K5

**K1-** Remember; **K2-** Understand; **K3-** Apply; **K4-**Analyze; **K5-**Evaluate

Units	Content	No. of hours
I	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.	15
II	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.	15
III	Probability: Theories and rules; Probability - Addition and multiplication theorem; Probability distribution: Properties and application of Normal, Binomial and Poisson distributions.	15
IV	Hypothesis testing: Student 't' test - paired sample and mean difference 't' tests. Correlation: Types - Karl Pearsons Co-efficient, Rank correlation, Significance test for correlation coefficients. Regression analysis: Computation of biological data, calculation of regression coefficient, graphical representation and prediction.	15
V	Analysis of variance: one way and two-way classification. Data analysis with comprehensive statistical software using Statistical Package for the Social Sciences (SPSS).	15

<b>Self-Study</b>	Graphic methods: Frequency polygon and ogive curve; Diagrammatic representation: Histogram, bar diagram, pictogram and pie chart.
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### Textbooks

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. Pillai, R.S.N. and V. Bagavathi (2016). *Statistics Theory and Practice* (8<sup>th</sup>ed.). New Delhi: S. Chand Publishing Company Ltd.
2. Khan, I. and Khanum, A. (2014). *Fundamentals of Biostatistics* (3<sup>rd</sup> ed.): Hyderabad. Ukaaz Publications.
3. Zar, J.H. (1984). *Biostatistical Analysis* (2<sup>nd</sup> ed.). London: Prentice-Hall International Inc.
4. Bailey, N.T.J. (1997). *Statistical methods in Biology* (3<sup>rd</sup> ed.). New York: Cam. University Press.
5. Sokal, R. and James, F. (1973). *Introduction to Biostatistics*. Tokyo, Japan: W.H. Freeman and Company Ltd.
6. Daniel, W.W. (1987). *Biostatistics: A foundations for Analysis in the Health Sciences*. New York: John Wiley & Sons.
7. Gupta, S.P. (1998). *Statistical Methods*. New Delhi: S. Chand and Company Ltd.
8. Banerjee, P.K. (2005). *Introduction to Biostatistics*. New Delhi: S. Chand and Company Ltd.
9. Pranab Kumar Banerjee (2009). *Introduction to Biostatistics*, New Delhi: S. Chand and Company Ltd.

### Web Resources

1. [https://faculty.ksu.edu.sa/sites/default/files/introduction\\_to\\_biostatistics-106.pdf](https://faculty.ksu.edu.sa/sites/default/files/introduction_to_biostatistics-106.pdf)
2. [https://www.youtube.com/watch?v=1Q6\\_LRZwZrc](https://www.youtube.com/watch?v=1Q6_LRZwZrc)
3. [https://www.youtube.com/watch?v=7CqolAC\\_owc](https://www.youtube.com/watch?v=7CqolAC_owc)
4. <https://www.ibm.com/docs/en/spss-statistics/25.0.0?topic=tutorial>
5. <https://www.statisticshowto.com/probability-and-statistics/spss-tutorial-beginners/>

#### MAPPING WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO 1</b>	3	1	1	x	1	1	3
<b>CO 2</b>	3	3	2	1	2	2	3
<b>CO 3</b>	3	2	2	x	x	3	3
<b>CO 4</b>	3	2	1	1	2	3	3
<b>CO 5</b>	3	3	2	2	2	3	3
<b>TOTAL</b>	15	11	8	4	7	12	15
<b>AVERAGE</b>	3	2.2	1.6	0.8	1.4	2.4	3

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

#### MAPPING WITH PROGRAMME SPECIFIC OUTCOMES

COs	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	2	3	3	2	3
<b>CO3</b>	2	3	3	3	2
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	2	3	3	3
<b>Total</b>	13	14	15	14	14
<b>Average</b>	2.6	2.8	3	2.8	2.8

**SEMESTER I**  
**ELECTIVE COURSE - II (b) APPLIED ZOOLOGY**

Course Code	L	T	P	S	Credits	Inst. Hours	Total hrs	Marks		
								CIA	External	Total
ZP231EC5	3	1	-	1	3	5	75	25	75	100

**Prerequisite:**

A genuine passion towards the culture of economically important cultivable organisms.

**Learning Objectives**

1. To deepen the knowledge of students in general and applied areas of Zoology.
2. To provide employment and job opportunities in the public, private and government sector.

**Course Outcomes**

Upon completion of this course the students will be able to:		
CO - 1	apply the knowledge of animal husbandry in economic development.	<b>K1</b>
CO - 2	identify the kinds of bees and the methods of bee keeping.	<b>K2</b>
CO - 3	rear silkworms, harvest and market the cocoons.	<b>K3</b>
CO - 4	apply skills and experience about the management of poultry and Dairy farming.	<b>K4</b>
CO - 5	culture of economically important finfish and shell fishes.	<b>K5</b>

Units	Content	hours
I	<b>Apiculture:</b> Scope – classification and kinds of bees – bees and their society – life cycle of <i>Apis indica</i> – food of honey bees - relationship between plants and bees. Methods of bee keeping (primitive and modern) – Honey bee products: honey, bee wax, bee venom. <b>Lac culture</b> – scope – lac insect <i>Laccifer lacca</i> and its life cycle – processing of lac - lac products and importance.	15
II	<b>Sericulture:</b> Scope – Silk Road - CSB - Moriculture: varieties of mulberry, methods of propagation, harvesting of leaves – Common species of Silkworm– Life cycle of mulberry silkworm – Diseases of silkworm: pebrine, grasserie, sotto diseases, muscardine – pest of silkworm: uzifly. Rearing of silkworm – mounting – spinning - harvesting of cocoons – silk reeling and marketing.	15
III	<b>Poultry Keeping:</b> Scope – commercial layers and broilers - poultry housing - types of poultry houses – management of chick, growers, layers and broilers – debeaking - sexing in chicks - Nutritive value of egg. Diseases of poultry – Ranikhet, Fowl pox, Coryza, Coccidiosis, Polyneuritis – vaccination.	15
IV	<b>Dairy Farming:</b> Scope – Breeds of Dairy animals – Establishment of a typical Dairy farm – Management of cow (Newborn, calf, Heifer, milking cow) – Diseases (Mastitis, Rinder Pest, FMD). Nutritive value of milk - dairy products (Standard milk, skimmed milk, toned milk and fermented milk-curd, ghee, cheese) Pasteurization. Leather industry – scope – processing of skin.	15
V	<b>Integrated Farming:</b> Definition and Scope. Agri-based fish farming – paddy cum fish culture – Horticulture-cum-fish farming. Integrated bee keeping - Live-stock fish farming - Duck-cum fish culture, fish-cum poultry farming, fish cum dairy farming, goat-cum fish integration, fish cum pig farming - multi-trophic aquaculture – Livestock – Poultry – Fish – Horticulture	15

### Text Books

Arumugam, N., Murugan, T., Johnson Rajeshwar, J. and Ram Prabhu, R. (2011). *Applied Zoology*. Nagercoil: Saras Publications.

### Reference Books

1. Vasantharaj David, B. (2004). *General and Applied Entomology* (2<sup>nd</sup> ed.). New Delhi: Tata McGraw-Hill Publishing Company Ltd.
2. Johnson, J. and Jeya Chandra, I. (2005). *Apiculture*. Marthandam: Olympic Grafix.
3. Tharadevi, C.S., Jayashree, K.V. and Arumugam, N. (2014). *Bee Keeping*. Nagercoil : Saras Publications.
4. Johnson, M. and Kesary, M. (2015). *Sericulture* (5<sup>th</sup> ed.). Marthandam: CSI Press.
5. Ganga, G. and Sulochana Chetty (1997). *An Introduction to Sericulture*. Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
6. Gnanamani, M.R. (2005). *Profitable Poultry Farming*. Madurai: J. Hitone Publications.
7. Shukla, G.S. and Upadhyay, V.B. (1998). *Economic Zoology*. Jaipur: Rastogi Publications.
8. John Moran (2005). *Tropical Dairy Farming*. Australia: Landlinks Press.
9. Uma Shankar Singh (2008). *Dairy Farming*. New Delhi: Anmol Publishers.

### Web Resources

1. <https://guides.library.charlotte.edu/c.php?g=173165&p=1142033>
2. <https://www.slideshare.net/ManoKhan88/1-basic-concepts-in-economic-zoologypptx>
3. <https://egov.uok.edu.in/elearning/tutorials/1011020512BR15103CR15Apiculture%20Lac%20culture%20and%20sericultureapiculture%20lac%20culture%20and%20sericulture%20upload.pdf>
4. <https://www.echocommunity.org/en/resources/e7940e6c-ebbb-4b78-9115-fa5de38fa0d7>
5. <https://www.fao.org/documents/card/en?details=cb5353en>

### MAPPING WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	1	1	-	1	1	3
CO 2	3	3	2	1	2	2	3
CO 3	3	2	2	-	-	3	3
CO 4	3	2	1	1	2	3	3
CO 5	3	3	2	2	2	3	3
TOTAL	15	11	8	4	7	12	15
AVERAGE	3	2.2	1.6	0.8	1.4	2.4	3

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

### MAPPING WITH PROGRAMME SPECIFIC OUTCOMES

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	2	3	3	2	3
CO3	2	3	3	3	2
CO4	3	3	3	3	3
CO5	3	2	3	3	3
Total	13	14	15	14	14
Average	2.6	2.8	3	2.8	2.8

**SEMESTER I**  
**ELECTIVE COURSE – II (c) PEST MANAGEMENT**

Course Code	L	T	P	S	Credits	Inst. Hours	Total hrs	Marks		
								CIA	External	Total
ZP231EC6	3	1	-	1	3	5	75	25	75	100

**Pre requisite:**

Need to have a fundamental understanding of entomology, plant pathology, and integrated pest management strategies.

**Learning Objectives**

1. To provide awareness on various pests and their control measures.
2. To apply Integrated Pest Management strategies to resonate home based food products with the general public.

**Course Outcomes**

CO	Upon completion of this course the students will be able to:	
CO - 1	outline the pest groups affecting different agricultural crops and control measures.	<b>K1</b>
CO - 2	select correct IPM in cropping systems with traditional and alternative control measures.	<b>K2</b>
CO - 3	analyze the impact of pesticides on environment and adopt better agricultural practices.	<b>K3</b>
CO - 4	evaluate the control measures adopted for pests of household and stored products.	<b>K4</b>

Units	Content	No. of hours
<b>I</b>	<b>Introduction:</b> definition of pest – outline of pest groups affecting agricultural crops – population dynamics of pests – causes for pest outbreaks. Pest control methods: cultural, chemical and biological - pesticides, precautions, safety devices - pesticide poisoning symptoms and first aid.	15
<b>II</b>	<b>Pesticides:</b> organochlorine, organophosphorus and organocarbamates – inorganic and natural pesticides. Preparation of pesticides: formulations – packages, manufacture. Toxicity levels – LD <sub>50</sub> values. Mode of action of pesticides.	15
<b>III</b>	<b>Pests of Agricultural importance:</b> bionomics and life cycles of any two pests of the following: cereals (rice); oilseeds (coconut, groundnut); vegetables (brinjal); pulses; plantation crops (coffee); fruits (citrus) and pesticide formulations.	15
<b>IV</b>	<b>Household pests and Pests of stored products:</b> household pests (cockroaches, termites, silverfish, flies and mosquitoes) and their control measures. Rodents as pests – local rodents, life history, feeding habits, reproduction, and behaviour – methods of rodent control. Stored grain pest (rice weevil, flour beetle, cigarette beetle).	15
<b>V</b>	<b>Mode of Pest Control:</b> Pesticide spraying appliances. Residual toxicity of pesticides – Environment degradation and its prevention. Biological control of pest – parasites, predators, and pathogens – chemosterilants – pheromones - Baculovirus-mediated pest control. Integrated pest management and its relevance to 21 <sup>st</sup> century.	15

**Text Book**

Dhawan, A.K., Balwinder Singh, Manmeet B Bhullar (2012). *Integrated Pest Management*. Chennai: Scientific Publishers.

### Reference Books

1. Nayar, Ananthakrishnan and David (1976). *General and Applied Entomology*. New Delhi: Tata McGraw Hill Publishers.
2. Metcalf and Flint (1973). *Destructive and useful Insects* (4<sup>th</sup> ed.). New Delhi: Tata McGraw Hill Publishers.
3. Roy, D.N. and Abrown, A.W. (1981). *Entomology: Medical and Veterinary* (3<sup>rd</sup> ed.). Bangalore: The Bangalore Printing and publishing company.
4. Cremllyn, R. (1979). *Pesticides: Preparation and mode of Action*. New Jersey: John Wiley & Sons Ltd.
5. Ignacimuthu, S. and B V David (2009). *Ecofriendly Insect Pest Management*. Delhi: Elite Publishing House Pvt Ltd (Ind).

### Web Sources

1. <https://guides.library.cornell.edu/c.php?g=672215&p=4733120>
2. <https://growingsmallfarms.ces.ncsu.edu/growingsmallfarms-insectlinks/>
3. <https://content.ces.ncsu.edu/insect-and-related-pests-of-vegetables>
4. <https://content.ces.ncsu.edu/insect-management-on-organic-farms>
5. <https://www.epa.gov/ipm/integrated-pest-management-tools-resources-support-ipm-implementation>

#### MAPPING WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
<b>CO 1</b>	3	1	1	x	1	1	3
<b>CO 2</b>	3	3	2	1	2	2	3
<b>CO 3</b>	2	2	3	2	3	3	3
<b>CO 4</b>	3	2	3	1	2	3	3
<b>TOTAL</b>	11	8	9	4	8	9	12
<b>AVERAGE</b>	2.75	2	2.25	0.8	2	2.25	5

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

#### MAPPING WITH PROGRAMME SPECIFIC OUTCOMES

COs	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	2	3	3	2	3
<b>CO3</b>	2	3	3	3	2
<b>CO4</b>	3	3	3	3	3
<b>Total</b>	10	12	12	11	11
<b>Average</b>	2.5	3	3	2.5	2.5

**SEMESTER I**  
**ELECTIVE LAB COURSE I: MOLECULES AND THEIR INTERACTION RELEVANT TO**  
**BIOLOGY & BIOSTATISTICS**

Course Code	L	T	P	S	Credits	Inst. Hours	Total hrs	Marks		
								CIA	External	Total
ZP231EP1	-	-	2		2	2	30	25	75	100

**Pre-requisite**

Basic practical knowledge on the molecules and their interaction to animal body and analysis of quantitative and qualitative information from biological samples.

**Learning Objectives:**

1. Understanding the salient features and functional anatomy of different systems and the skeletal system in invertebrates & vertebrates.
2. To design experimental problems, analyze and evaluate critically with inferential biostatistics.

**Course Outcomes**

COs	Upon completion of this course the students will be able to:	KL
CO1	learn and study of chemical and physical structure of biological macromolecules.	K1
CO2	analyze the biomolecules and physicochemical parameters in samples	K2
CO3	analyze and interpret the collected data using statistical methods	K3
CO4	design biological experiments and evaluate the samples applying appropriate statistical methods.	K4

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

**Molecules and their Interaction Relevant to Biology**

1. Colorimetry- Verification of Beer-Lambert's law.
2. Preparation of solutions in normality, percentage, ppt, ppm
3. Quantitative estimation of glucose (Blood/ tissue) Standard graph method
4. Determination of velocity of salivary amylase activity by applying Michaelis - Menten equation.
5. Determination of pH of unknown solution using Known pKa – Application of Henderson – Hasselbalch equation.

**Instruments/Charts/Models:** Colorimeter, pH Meter, Centrifuge, Chromatogram, PAGE

**Biostatistics**

6. Measures of central tendency: mean, median and mode.
7. Measures of dispersion- Standard deviation and standard error.
8. Correlation co-efficient: Length and width of molluscan shells.
9. Probability: Coin tossing (two coin and three coin)
10. Test of significance (student's *t*-test).

**Charts/ Models:** Histogram, polygon frequency, pie chart, cartogram, bar diagram

**Reference Books**

1. Geetha K. Damodaraan, 2010. Practical Biochemistry. Jaypee Brothers Medical Publishers Pvt. Ltd.
2. Divya Shanthi, 2018. An easy guide for practical Biochemistry. Jaypee Brothers Medical Publishers Pvt. limited, 01-Nov-2008 -
3. Gupta, S.P.(1998). Statical methods. New Delhi: S. Chand and Company Ltd.
4. Gurumani, N. An introduction to Biostatistics. 2004. MJP publishers, Triplicane, Chennai.



### MAPPING WITH PROGRAMME OUTCOMES

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>
<b>CO 1</b>	3	3	1	2	3	1	3
<b>CO 2</b>	3	2	2	2	2	1	3
<b>CO 3</b>	3	3	2	2	3	2	3
<b>CO 4</b>	3	2	1	1	3	2	2
<b>Total</b>	12	10	6	7	11	6	11
<b>Average</b>	3	2.5	1.5	1.75	2.75	1.5	2.75

3 – Strong, 2- Medium, 1- Low

### MAPPING WITH PROGRAMME SPECIFIC OUTCOMES

<b>COs</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	2	3	2	2	3
<b>CO3</b>	2	2	3	3	2
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	2	2	3	3	3
<b>Total</b>	12	12	14	14	14
<b>Average</b>	2.4	2.4	2.8	2.8	2.8

**SEMESTER I**  
**SPECIFIC VALUE ADDED COURSE**  
**BASICS OF EXCEL**

Course Code	Credits	Total Hours	Total Marks
ZP231V01	1	30	100

**Prerequisite:**

Basic computer literacy and familiarity with navigating computer applications.

**Objectives:**

To equip the students to present data using Excel's various features and printing options.

COs	On completion of this course, students will be able to	KL
CO 1	recall the components of Excel's interface and basic cell formatting.	K1
CO 2	summarize the significance of relative, absolute, and mixed cell references in formulae.	K2
CO 3	apply data entry techniques and utilize basic calculations and formulas.	K3
CO 4	analyze different chart types to determine their suitability for presenting specific types of data.	K3
CO 5	evaluate the effectiveness of using functions and charts to ensure clarity and effective visualization.	K5
CO 6	design and create various types of charts (bar, column, pie) based on specific data sets.	K6

**Unit 1: Excel Essentials and Interface:** Introduction to Excel's - Excel interface, workbooks, and sheets – selection of cells, rows, and columns - basic cell formatting: font, alignment, and fill.

**Unit 2: Data Entry, Formulas, and Functions:** Data entry techniques and AutoFill - Introduction to formulas and basic calculations - Using SUM, AVERAGE, COUNT, and other functions - cell references: relative, absolute, and mixed.

**Unit 3: Data Management and Analysis:** Sorting and filtering data using find and replace to manipulate data – Data analysis using excel (t test, Regression, Correlation, ANOVA), data validation for data integrity.

**Unit 4: Charts and visualization:** Creating different chart types: bar, column, and pie charts - formatting and enhancing charts for clarity - Adding labels, titles, and legends to charts.

**Unit 5: Printing, Sharing, and Review:** Setting up print options and page layout - printing worksheets and workbooks - sharing workbooks via email and cloud storage - review of key concepts and practical exercises.

**Reference books:**

1. Kabir Das. 2021. Microsoft Excel: Short keys and formulas. Notion Press, India.
2. Maneet Singh Mehta. 2021. Microsoft Excel Professionals. 2021 guide. BPB Publications, India.
3. Lokesh Lalwani. 2019. Excel 2019 – All in one. 1<sup>st</sup> Edn. BPB Publications, India.
4. John Walkaenbach. 2015. Microsoft Excel 2016 Bible – Comprehensive tutorial resource. John Wiley and Sons, Indiana.
5. Greg Harvey. 2016. Microsoft Excel 2016. Dummis Publisger

## SEMESTER II

### CORE COURSE III: CELLULAR AND MOLECULAR BIOLOGY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP232CC1	4	1	-	1	5	6	90	25	75	100

#### Pre-requisite

Students should have knowledge of the basic cellular structures and their salient functions.

#### Learning Objectives

1. To acquire knowledge on molecular organization of the cell and cell organelles, growth, and communications.
2. To develop skills needed to innovate and contribute to the advancement in cell and molecular biology.

#### Course Outcomes

<b>On the successful completion of the course, students will be able to:</b>		
<b>1.</b>	recall general concepts of cell biology and fundamental cellular structures and organelles.	<b>K1</b>
<b>2.</b>	explain the various cellular components and their activities.	<b>K2</b>
<b>3.</b>	identify the changes or losses in cell function caused by dysregulation.	<b>K3</b>
<b>4.</b>	compare different cellular processes, their regulation, and their significance.	<b>K4</b>
<b>5.</b>	assess the societal and environmental impacts through cellular and molecular research.	<b>K5</b>

**K1-** Remember; **K2-** Understand; **K3-** Apply; **K4-**Analyze; **K5-**Evaluate

Units	Contents	No. of Hours
I	General features of the cell: Cell theory; Diversity of cell size and shapes. Protoplasm and deutoplasm – cell organelles; Membrane structure and functions - membrane models, membrane/channel proteins, diffusion, osmosis, active transport, ion pumps (Sodium and potassium pump).	18
II	Cell organelles: Ultra-structure and functions of intracellular organelles – nucleus, nuclear pore complex, nucleolus, chromosomes, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, centrosomes, peroxisomes, ribosomes.	18
III	Cell cycle and cell division: Phases of Cell Cycle – Mitosis, Significance of Mitosis - meiosis, significance of meiosis. Control of the cell cycle - regulator molecules - positive regulation - negative regulation. Structure of DNA and RNA; Process of DNA replication, transcription, and translation in pro- and eukaryotic cells.	18
IV	Cell communication and cell signaling: Membrane - associated receptors for peptide and steroid hormones - signaling through G-protein coupled receptors, signal transduction pathways (RTK pathway and MAP kinase pathway). Gap junction and tight junction, extracellular space and matrix, interaction of cells with other cells and non-cellular structures.	18

V	Cancer cells: Characteristic features of normal and cancer cells. Carcinogens: types and cancer induction. Metastasis. Oncogenes and tumor suppressor genes, therapeutic interventions of uncontrolled cell growth. Apoptosis – mechanism and regulation. Ageing and senescence.	18
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<b>Self-study</b>	Diversity of cell size and shapes, Ultra-structure and functions of lysosomes, Stages in cell cycle, Gap junction and tight junction, Characteristic features of normal and cancer cells.
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### Textbooks

1. Plopper, G., D. Sharp, and E. Sikorski. 2015. *Lewin's Cells* (Third Edition), Jones & Bartlett, New Delhi.
2. Ajoy Paul, 2011. *Textbook of Cell and Molecular Biology*, Books and Allied Pvt. Ltd.

### Reference Books

1. Alberts, B., A. Johnson, J. Lewis, *et al.*, 2015. *Molecular Biology of the Cell* (Sixth Edition), Garland Science, New York.
2. Lodish, H., C. A. Kaiser, A. Bretscher, *et al.*, 2013. *Molecular Cell Biology* (Seventh Edition), Macmillan, England.
3. Karp, G. 2010. *Cell Biology* (Sixth Edition), John Wiley & Sons, Singapore.
4. Tropp, B, 2008. *Molecular Biology Genes to Proteins* (Third Edition), Jones & Bartlett, US.
5. Abbas, A. K., A. H. Lichtman and S. Pillai, 2007. *Cell and Molecular Immunology* (Sixth Edition), Saunders, Philadelphia.

### Web Resources

1. <https://www.inspiritvr.com/general-bio/cell-biology/passive-and-active-transport-study-guide>
2. <https://www.khanacademy.org/test-prep/mcat/cells/eukaryotic-cells/a/organelles-article>
3. <https://www.khanacademy.org/science/ap-biology/cell-communication-and-cell-cycle/changes-in-signal-transduction-pathways/a/intracellular-signal-transduction>
4. [https://bio.libretexts.org/Bookshelves/Cell\\_and\\_Molecular\\_Biology/Book%3A\\_CellsMolecules\\_and\\_Mechanisms\\_\(Wong\)/11%3A\\_Protein\\_Modification\\_and\\_Trafficking/11.02%3A\\_Protein\\_Trafficking](https://bio.libretexts.org/Bookshelves/Cell_and_Molecular_Biology/Book%3A_CellsMolecules_and_Mechanisms_(Wong)/11%3A_Protein_Modification_and_Trafficking/11.02%3A_Protein_Trafficking)
5. <https://openoregon.pressbooks.pub/mhccmajorsbio/chapter/control-of-the-cell-cycle/>

## MAPPING WITH PROGRAMME OUTCOMES PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3	3	3	3	2	3	3	3
<b>CO2</b>	3	3	1	2	2	2	2	3	1	2	2	1
<b>CO3</b>	3	3	3	3	3	3	2	2	3	2	3	2
<b>CO4</b>	3	3	1	2	2	2	2	2	3	2	3	2
<b>CO5</b>	2	3	3	3	3	3	3	2	3	3	2	3
<b>TOTAL</b>	14	15	11	13	13	13	12	12	12	12	13	11
<b>AVERAGE</b>	2.8	3.0	2.2	2.6	2.6	2.6	2.4	2.4	2.4	2.4	2.6	2.2

**3-Strong, 2- Medium, 1- Low**

**SEMESTER II**  
**CORE COURSE IV: DEVELOPMENTAL BIOLOGY**

Course Code	L	T	P	S	Credits	Inst. Hours	Total hrs	Marks		
								CIA	External	Total
ZP232CC2	4	1	-	1	5	6	90	25	75	100

**Pre-requisite**

A basic understanding of biology and genetics is recommended to effectively grasp the concepts in developmental biology.

**Learning Objectives**

1. Understand the principles of developmental biology to analyze and compare the embryonic development of different animal species.
2. Study the concepts, procedures, and uses of genes and hormones to propose strategies to improve and control the development of certain animal species.

**Course Outcome**

On the successful completion of the course, student will be able to:		
<b>CO - 1</b>	recall and summarize the chief events in animal development, recognizing their significance and historical context	<b>K1</b>
<b>CO - 2</b>	understand the different mechanisms and how extrinsic and intrinsic factors influence embryonic development in various animal embryos.	<b>K2</b>
<b>CO - 3</b>	apply their knowledge to explain the role of hormones in animal development.	<b>K3</b>
<b>CO - 4</b>	analyze the different stages of embryonic development and the genetic control mechanisms involved.	<b>K4</b>
<b>CO - 5</b>	critically evaluate ethical issues associated with cryopreservation in mammalian reproduction.	<b>K5</b>
<b>CO - 6</b>	design and propose experiments related to biochemical changes during regeneration or cryopreservation techniques.	<b>K6</b>

**K1-** Remember; **K2-** Understand; **K3-** Apply; **K4-**Analyze; **K5-**Evaluate; **K6-** Create

Units	Contents	No. of Hours
I	Pattern of animal development: Chief events in animal development. 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.	18
II	Fertilization: Sperm aggregation, sperm activation, chemotaxis, sperm maturation and capacitation 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.	18
III	Cleavage and gastrulation: Pattern of embryonic cleavage, mechanisms of cleavage – Gastrulation - morphogenic movements - gastrulation in respective animal embryos (Sea urchin, Amphibians, Mammals); Fate maps - (Amphibian and Chick), Epigenesis and preformation – Formation of primary germ layers	18
IV	Embryonic Development; Embryonic development of fish and birds, formation of extra embryonic membranes in mammal –Formation and migration of neural crest cells - types of neural crest cells - primary and secondary neurulation. Organogenesis (mammal): Development of ectodermal derivatives (nervous	18

	system). endodermal (digestive system), mesodermal (circulator system). Gene and development: Anterior- posterior axis in determination in drosophila, Maternal effect genes - <i>Bicoid</i> and <i>Nanos</i> proteins; Generation of dorsal - ventral polarity- Genetic control of segmentation – Gap genes; pair rule genes; Homeotic genes	
V	Post embryonic development metamorphosis: Endocrine control of metamorphosis in insect and amphibian - Endocrine control of moulting and growth in crustaceans and insects - Neoteny and pedogenesis. Regeneration: Types of regeneration, Regeneration in planaria and frog - Regenerative ability in different animal groups. Factors stimulating regeneration. – Aging and senescence: Biology of senescence- cause of aging- mechanism involved in apoptosis. Experimental Embryology: Mammalian reproduction: Mammalian reproductive cycle, Hormonal regulation, Endocrine changes associated with normal pregnancy, Induced ovulation in humans – Cryopreservation of gametes/embryos - Ethical issues in cryopreservation	18

<b>Self-study</b>	Spermatogenesis, Oogenesis in amphibians, parthenogenesis, Fate maps, Regenerative ability in different animal groups..
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### Textbooks

1. Gilbert. S. F. 2006. *Developmental Biology*, 8th Edition, INC Publishers, USA
2. Balinsky, B. I. 1981. *Introduction to Embryology*. (5th Edition), CBS College Publishers, New York.

### Reference books

1. Tyler, M.S, 2000. *Developmental Biology - A Guide for Experimental Study*, Sunderland, MA.
2. Subramoniam, T, 2011. *Molecular Developmental Biology* (2nd Edition), Narosa Publishers, India.
3. Slack J.M.W, 2012. *Essential Developmental Biology* (3rd Edition), Wily-Blackwell Publications, USA.
4. Mari-Beffa, M. and J. Knight, 2005. *Key Experiments in Practical Developmental Biology*, Cambridge University Press, UK.
5. Lewis Wolpert, Cheryll Tickle, Alfonso Martinez Arias, 2019. *Principles of Development*. Sixth Edition. Oxford University Press, USA.

### Web resources

1. <https://www.easybiologyclass.com/tag/developmental-biology/>
2. [www.studocu.com](http://www.studocu.com) > document > lecture-notes > view
3. [ocw.mit.edu](http://ocw.mit.edu) > courses > 7-22-developmental-biology-f.
4. <https://learninglink.oup.com/access/barresi-12e>
5. <https://www.khanacademy.org/science/biology/developmental-biology>

### MAPPING WITH PROGRAMME OUTCOMES PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PO7
CO1	3	2	1	3	2	3	3	3	2	3	2	2
CO2	3	1	1	3	2	3	3	3	2	2	3	2
CO3	3	2	1	2	2	2	2	2	3	2	2	2
CO4	3	1	1	3	1	3	3	3	3	3	3	2
CO5	3	2	1	2	3	3	2	3	2	2	2	2
<b>Total</b>	15	8	5	13	10	14	13	14	12	12	12	10
<b>Average</b>	3	1.6	1	2.6	2	2.8	2.6	2.8	2.4	2.4	2.4	2

3 - Strong; 2 - Medium; 1 - Low

**SEMESTER II**  
**CORE LAB COURSE II: LAB COURSE IN CELL BIOLOGY AND DEVELOPMENTAL BIOLOGY**

Course Code	L	T	P	S	Credits	Inst. Hours	Total hrs	Marks		
								CIA	External	Total
ZP232CP1	-	-	4	-	2	4	60	25	75	100

**Pre-requisite**

Students should have acquired basic knowledge relevant to this lab course.

**Learning Objectives**

1. To demonstrate significant cellular, molecular biological principles into practical understanding.
2. To gain theoretical knowledge and hands-on skills in developmental biology.

**Course Outcomes**

1.	recall the principles of using a micrometer for cell size determination and the stages of mitosis & meiosis and their characteristics.	K1
2.	comprehend the steps involved in preparing blood smears and mounting the muscle fibres using microscopy.	K2
3.	develop handling - skills through the wet-lab course.	K3
4.	interpret observations & make connections between reproductive processes and the ecological context of the organisms studied	K4
5.	evaluate and compare different developmental stages in chick embryos.	K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;

**Cell and Molecular Biology**

1. Determination of cell size using micrometer.
2. Identification of Mitotic stages in onion root tips.
3. Identification of various stages of meiosis in the testes of grasshopper.
4. Observation of polytene chromosome in salivary gland cells of Chironomus larva.
5. Detection of sex chromatin in squamous epithelium.
6. Identification of blood cells in the haemolymph of the cockroach.
7. Identification of blood cells in human blood.
8. Mounting of the coxal striated muscle fibers of cockroach.
9. Observation of adipocytes - fat body of cockroach.
10. Isolation of total RNA from bacterial cells/ tissues. (Demonstration)

**Spotters:** Fluid mosaic model, Golgi complex, Cancer cell, Cadherins, Karyotype, Haemocytometer.

**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, calottes and mammals.
3. **Fertilization:** Induced spawning in fish.
4. **Embryogenesis:** Observation and whole mount preparation of the
  - i. Chick blastoderm - 18 hours of development
  - ii. Chick embryonic stage - 24 hours of development
  - iii. Chick embryonic stage - 48 hours of development
  - iv. Chick embryonic stage - 72 hours of development
  - v. Chick embryonic stage - 96 hours of development
5. **Histological observation:** Section through various developmental stages in chick embryo
6. **Experimental Embryology:** Regeneration in Frog Tadpoles - Blastema formation.
7. **Metamorphosis:** Demonstration of metamorphosis in Frog Tadpole using exogenous Iodine
8. **Cryopreservation:** Demonstration of cryopreservation of gametes of fin fish/shell fish

**Reference books:**

1. Renu Gupta, Seema Makhija, Dr. Ravi Toteja, 2018. *Cell Biology : Practical Manual*. Prestige Publishers, Idia.

2. Mamta Verma, 2023. Practical Book Cell Biology & Cytogenetics Lab. Krishna Prakashan Media (P) Ltd., Idia.
3. Wilt, F.H. and N.K. Wessel, 1967. Methods in Developmental Biology, Thomas Y Crowell, New York.
4. Slack J.M.W, 2012. Essential Developmental Biology (3<sup>rd</sup> Edition), Wily-Blackwell Publications, USA, pp-496.
5. Mari-Beffa, M. and J. Knight, 2005. Key Experiments in Practical Developmental Biology, Cambridge University Press, UK, pp-404.

**MAPPING WITH PROGRAMME OUTCOMES**  
**MAPPING WITH PROGRAMME SPECIFIC OUTCOMES**

<b>Cos</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	2	1	3	2	3	2	3	3	2	3	2
<b>CO2</b>	3	1	1	3	2	3	2	3	3	2	2	3
<b>CO3</b>	3	2	1	2	2	2	2	2	2	3	2	2
<b>CO4</b>	3	1	1	3	1	3	2	3	3	3	3	3
<b>CO5</b>	3	2	1	2	3	3	2	2	3	2	2	2
<b>Total</b>	15	8	5	13	10	14	10	13	14	12	12	12
<b>Average</b>	3	1.6	1	2.6	2	2.8	2	2.6	2.8	2.4	2.4	2.4

**3 - Strong; 2 - Medium; 1 - Low**



## SEMESTER II

### ELECTIVE COURSE III: a) ECONOMIC ENTOMOLOGY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP232EC1	2	1		1	3	4	60	25	75	100

#### Pre-requisite

Basic background in biological sciences with a special emphasis on the study of insects.

#### Learning Objectives

1. Develop the ability to identify and classify insects into major orders and understand their economic importance.
2. Acquire practical skills in observing and documenting the life cycles and behaviors of beneficial and destructive insects.

#### Course Outcomes

<b>On the successful completion of the course, students will be able to:</b>		
1.	recall the features of various insect orders and describe the life history, social organization, and management practices of insects.	<b>K1</b>
2.	understand the biology of insects associated with medical, household, and veterinary/public health importance.	<b>K2</b>
3.	apply their knowledge of pest biology to assess damage and beneficial insect life cycles to practical rearing.	<b>K3</b>
4.	analyze the causes of pest outbreaks and the economic threshold levels.	<b>K4</b>
5.	synthesize knowledge to propose effective control measures for vectors associated with medical, household, and veterinary/public health importance.	<b>K5</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate;

Unit	Contents	No. of hours
I	Overview of insects and insect taxonomy: Insects and their biological success - Man and insects; Salient features of Class Insecta and orders - Orthoptera, Isoptera, Hemiptera, Diptera, Coleoptera, Lepidoptera, Dermaptera, Odonata, Neuroptera and Hymenoptera. Basic concepts in Insect Taxonomy and classification.	12
II	Beneficial insects: Silkworms - types, life cycle of <i>Bombyx mori</i> , diseases and its management and rearing methods - Types of honey bees, life history, social organization (colonies and caste system), honey bee care and management of bee hive - Lac insects - life history, lac cultivation; Pollinators, predators, parasitoids, scavengers, weed killers, soil-builders.	12
III	Destructive insects: Insect pests - definition - Categories of pests - Types of damage to plants by insects - Causes of pest outbreak - Economic threshold level - Biology of the insect pests - Pests of paddy, cotton, sugarcane, vegetables, coconut and stored grains cereals.	12
IV	Pest management/Control strategies: Methods and principles of pest control - Natural control, Artificial control, Merits and demerits or limitations of these methods in pest control - Development and uses of pest resistant plant varieties - Integrated pest management - Concepts and practice.	12
V	Vector biology: Stable fly and cattle fly; Fowl - shaft louse and chicken flea; sheep and goat - head maggot and sheep ked. Insects associated with	12

<p>medical importance and management - head louse <i>Pediculus humanuscapitis</i>, mosquitoes - <i>Anopheles</i>, <i>Culex</i>, <i>Aedes</i>, flea – <i>Xenopsylla cheopis</i>, eye fly, sand fly, ticks, mites and bed bug. Insects associated with household insects - cockroaches, termites and silverfish. Vectors of veterinary and public health importance - Mosquitoes as potential vectors of human diseases-control measures.</p>
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<b>Self-study</b>	Types of honey bees, Pest of Paddy, Natural control of pest.
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**Textbooks**

1. Ayyar, L.V. R, 1936. Hand book of Economic Entomology for South India. Narendra Publishing House. New Delhi.
2. Vasantharaj David, B. and V.V. Ramamurthy, 2016. Elements of Economic Entomology, Eighth Edition, Brillion Publishing, New York.
3. Ross. H.H. 195. A Text Book of Entomology, John Wiley & Sons Inc., New York.

**Reference Books**

1. Chapman, R.F., S.J. Simpson and A.E. Douglas, 2012. The Insects: Structure and Function, Fifth Edition, Cambridge University Press, Lodo.
2. Daly, H.V., J.T. Doyen and P.R. Ehrlich, 1978. Introduction to Insect Biology and Diversity. Mc Graw-Hill Kogakusha Ltd., Tokyo.
3. Hill, D.S, 1974. Agricultural Insect Pests of the Tropics and Their Control. Cambridge University Press, New York.
4. Krishnaswami. S, 1973. Sericulture Manual, Vol. I & II, Silkworm rearing, FAO Agricultural Science Bulletin, Rome.
5. Mani, M.S, 1982. General Entomology. Oxford & IBH Publishing Co., India.

**Web Resources**

1. <https://egyankosh.ac.in/bitstream/123456789/85342/1/Unit-4.pdf>
2. [https://www.rlbcu.ac.in/pdf/PGCourse/Entomology/Insect%20Taxonomy%20\(APE%20503\).pdf](https://www.rlbcu.ac.in/pdf/PGCourse/Entomology/Insect%20Taxonomy%20(APE%20503).pdf)
3. <https://egov.uok.edu.in/elearning/tutorials/1011020512BR15103CR15Apiculture%20Lac%20culture%20and%20sericultureapiculture%20lac%20culture%20and%20sericulture%20upload.pdf>
4. [https://agritech.tnau.ac.in/farm\\_enterprises/fe\\_api\\_pestanddiseases.html](https://agritech.tnau.ac.in/farm_enterprises/fe_api_pestanddiseases.html)
5. [https://cpacollege.ac.in/assets/uploads/1645091697APPLIED\\_ZOOLOGY\\_SEM\\_NOTE\\_pdf.pdf](https://cpacollege.ac.in/assets/uploads/1645091697APPLIED_ZOOLOGY_SEM_NOTE_pdf.pdf)

**MAPPING WITH PROGRAMME OUTCOMES**  
**MAPPING WITH PROGRAMME SPECIFIC OUTCOMES**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	3	2	3	2	3	3	3
CO2	3	2	3	3	2	3	2	3	3	2	2	3
CO3	2	2	3	3	2	2	2	2	2	3	2	2
CO4	2	2	3	3	2	2	2	2	3	3	3	3
CO5	2	2	3	3	2	2	2	2	2	2	3	3
<b>Total</b>	12	10	15	13	14	12	10	12	12	13	13	14
<b>Average</b>	2.4	2	3	2.6	2.8	2.4	2	2.4	2.4	2.6	2.6	2.8

**3 - Strong; 2 - Medium; 1-Low**

**SEMESTER II  
ELECTIVE COURSE III: b) PARASITOLOGY**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hrs.	Marks		
								CIA	External	Total
ZP232EC2	2	1	-	1	3	4	60	25	75	100

**Pre-requisite:**

The students with a basic background in biological sciences with a special emphasis on the study of parasites.

**Course Objectives:**

1. To enable the students to be aware of the cosmopolitan distribution of parasites.
2. Develop skills for employment in clinical laboratories and health departments.

**Course Outcomes**

On the successful completion of the course, student will be able to:		
1.	define the basic biology and life cycle of parasites including epidemiology, diagnosis, and treatment.	<b>K1</b>
2.	explain morphological characters of parasites, developmental stages and their infestation.	<b>K2</b>
3.	identify appropriate techniques and develop basic skills for detection of parasites.	<b>K3</b>
4.	analyse the medical and public health aspects of human parasitic infections.	<b>K4</b>
5.	compare the diagnostic methods of parasitic infestation in veterinary hospitals, clinics and research laboratories.	<b>K5</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit	Contents	No. of hours
I	Taxonomy and classification of parasites - origin and evolution of parasitism - host parasite relationship, classification of parasites and hosts - transmission of parasites - Parasitic zoonoses- pathogenesis - clinical manifestations of parasitic diseases.	12
II	Protozoan parasites: Introduction and classification. Intestinal Amoeba - Pathogenic free-living amoeba - Intestinal flagellates - Trypanosomiasis, Leishmaniasis, Balantoidiasis, Malaria, Isosporiasis, <i>Toxoplasmosis</i> , <i>Cryptosporidiosis</i> , <i>Pneumocystis</i> . Protozoans of minor medical importance.	12
III	Helminth parasites: <i>Trichuriasis</i> , <i>Trichinellosis</i> , Strongyloidiasis, Ascariasis, Enterobiasis, Filariasis, hookworm diseases, Dracunculiasis, Onchocerciasis, Loiasis, Larva migrants. Nematodes of lesser medical importance - Diphyllbothriasis, Taeniasis, Echinococcosis, Sparganosis, Schistosomiasis, Fascioliasis, Fasciolopsiasis, Paragonimiasis, Clonorchiasis, Trematodes of minor medical importance.	12
IV	<b>Parasitic Insects:</b> Prevalence, transmission, and control of parasitic infections. Parasitic infection in a compromised host. Applied Parasitology - Eosinophilia in parasitic infections, Nosocomial parasitic infections. Evasion and parasitic mode of life - morphological, biochemical, and ethological adaptations. Quality assurance and laboratory safety.	12

V	<b>Diagnostic methods in parasitology:</b> General rules for microscopical examination. Microscopical examination of blood, stool, urine, sputum and biopsy material for parasites. Cultural examination - preparation of media - techniques for cultivation of <i>E. histolytica</i> , Leishmania, Plasmodium. <i>Immunodiagnostic methods - IFA, AGD, IHA, IFAT, CFT, DAT, BF, DFAT.</i> Molecular characterization of stage specific antigen nucleotide probes for diagnosis of protozoan diseases.	12
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<b>Self-study</b>	host parasite relationship, Intestinal Amoeba, Quality assurance and laboratory safety, General rules for microscopical examination
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**Textbooks**

1. Jayaram Paniker C. K. & Sougata Ghosh, 2013. Paniker’s Textbook of Medical Parasitology. Jaypee Brothers Medical Publishers, Maharashtra, India.
2. Rajesh Karyakarte & Ajit Damle, 2008. *Medical Parasitology* (2<sup>nd</sup>ed.). Books and Allied (P) Ltd., Kolkata.

**Reference Books**

1. Ichhpujani R.L. & Rajesh Bhatia, 2002. *Medical Parasitology*. Jaypee printers. New Delhi
2. Patvaik, B.D, 2001. *Parasitic Insects*. Delhi: Dominant Publishers and Distributors.
3. Jones, A.W, 1976. *Introduction to Parasitology*:: Addison -Wesley Publishing Company. Boston, USA
4. Subah, C.P, 2001. *Textbook of Medical Parasitology*: All Publishers and Distributors. Chennai.
5. Elizabeth Zeibig, 2012. *Clinical Parasitology: A Practical Approach*. 2nd Edition. Saunders, United States.

**Web Resources**

1. [https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture\\_notes/health\\_science\\_students/medicalparasitology.pdf](https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_science_students/medicalparasitology.pdf)
2. <https://www.amboss.com/us/knowledge/general-parasitology/>
3. <https://www.jaypeedigital.com/eReader/chapter/9789352704804/ch1>
4. [https://www.physio-pedia.com/Parasitic\\_Infections](https://www.physio-pedia.com/Parasitic_Infections)
5. <https://www.mdpi.com/2414-6366/7/10/253>

**MAPPING WITH PROGRAMME OUTCOMES**  
**MAPPING WITH PROGRAMME SPECIFIC OUTCOMES**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	2	3	3	2	3	2	3	2	3	3	3
<b>CO2</b>	3	2	3	3	2	3	2	3	3	2	2	3
<b>CO3</b>	2	2	3	3	2	2	2	2	2	3	2	2
<b>CO4</b>	2	2	3	3	2	2	2	2	3	3	3	3
<b>CO5</b>	2	2	3	3	2	2	2	2	2	2	3	3
<b>Total</b>	12	10	15	13	14	12	10	12	12	13	13	14
<b>Average</b>	2.4	2	3	2.6	2.8	2.4	2	2.4	2.4	2.6	2.6	2.8

**3 - Strong; 2 - Medium; 1-Low**

**SEMESTER II**  
**ELECTIVE COURSE III: c) AGROCHEMICALS AND**  
**PEST MANAGEMENT**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hrs.	Marks		
								CIA	External	Total
ZP232EC3	2	1		1	3	4	60	25	75	100

**Pre-requisite**

The students with a basic background in biological sciences with a special emphasis on the study of fertilizers and insects' pests.

**Learning Objectives**

1. To enable the students to be aware of the various types of biological pesticides and their uses.
2. Able to control pest and about their selective mode of action. It also gives an account of eco-friendly biological pesticides.

**Course Outcomes**

On the successful completion of the course, student will be able to:		
1.	outline agrochemicals, their modes of action and their fate in the agro-ecosystem.	<b>K1</b>
2.	recognize pesticide families based on their specific modes of activity.	<b>K2</b>
3.	apply appropriate pesticide management strategies by evaluating specific pest type.	<b>K3</b>
4.	analyze the impact of agrochemicals and pesticides for effective pest management.	<b>K4</b>
5.	evaluate the efficacy of organic manures, chemical fertilizers, conventional pesticides and bio-pesticides for agronomical practices.	<b>K5</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit	Contents	No. of hours
I	Definition, classification, morphology, and internal systems; Plant pests – weeds, bacteria, fungi, Viruses, nematodes, molluscs, Arthropods, birds, mammals etc.; Causes of outbreak of pest, growth and development; Classification based on nature of damage: Public health pests, Agricultural pests, Domestic pests, Animal husbandry pests, Structural pests.	12
II	Manures: types, composition and value, sources of manures, Compost-Different composting technologies-Mechanical compost. plants-Vermicomposting- Green Manures - Oil cakes, Sewage Sludge-Biogas plant slurry.	12
III	Chemical fertilizers: Classification and value. N- fertilizers: Manufacturing of Ammonium Sulphate, Ammonium Chloride, Ammonium Nitrate and urea; P- fertilizers: sources, processing rock phosphate, bones for bone meal preparation; K- fertilizers: sources, Potassium Chloride, Potassium Sulphate and Potassium Nitrate; Biofertilizers: Classification and value; viz., <i>Rhizobium</i> , <i>Azotobacters</i> , <i>Azolla</i> , Blue Green Algae, VAM	12
IV	Conventional chemicals/ pesticides based on target species: Acaricides, Fungicides, Rodenticides, Nematicides, Molluscicides, Fumigants and	12

	Repellents; Based on chemical nature: Organophosphates; Organochlorines, Carbamates etc.; Structure, chemical name, physical and chemical properties; Mode of action, uses, toxicity; Application of Pesticides, devices used; dose estimation for field application.	
V	Potential pesticidal plants; Plant extracts and Bio-organisms: Azadirachtin and its role in pest control; Other biopesticides: Pyrethrins, Pyrethroids, Rotenone, Nicotine and Nicotinoids. Growth inhibitors or physiological antagonists, chemo-sterilant; pheromones and attractants; Insect growth regulators, juvenile hormones, moulting hormones; BT methodology, genetically modified and transgenic plants	12

<b>Self-study</b>	Types of manure, Biofertilizer: <i>Rhizobium</i> , <i>Azotobacters</i> , <i>Azolla</i> , Blue Green Algae,
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### Textbooks

1. Sathe, T. V. 2008. *Agrochemicals and Pest Management*. Daya Publishing House, New Delhi.
2. Patil, T. V. Sathe. 2003. *Insect Predators and Pest Management*. Daya Publishing House, New Delhi.

### Reference books

1. Dent, D, 2000. *Insect pest management*. 2nd edition. CAB International. E-pdf.
2. Roberts, D.A, 1978. *Fundamentals of Plant Pest Control*. First Edition. W. H. Freeman.
3. Koul, O. and Dhaliwal, G.S, 2003. *Phytochemical Biopesticides*, Harwood Academic Publishers, Amsterdam.
4. Pedigo, L.P, 1996. *Entomology and pest management*, Prentice Hall, N. Delhi.

### Web Resources

1. <https://ugcmoocs.inflibnet.ac.in/assets/uploads/1/165/5582/et/35%20script200306101003033939.pdf>
2. <https://byjus.com/biology/effects-of-agrochemicals/>
3. <https://www.vedantu.com/biology/agrochemicals>
4. <https://www.gov.nl.ca/ecc/files/env-protection-pesticides-business-manuals-applic-chapter7.pdf>
5. <https://courseware.cutm.ac.in/wp-content/uploads/2020/06/Lecture-Notes-IPDM.pdf>

### MAPPING WITH MAPPING WITH PROGRAMME OUTCOMES MAPPING WITH PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	2	3	3	2	3	3	3
CO2	3	2	3	3	2	2	2	3	3	2	2	3
CO3	3	2	3	3	2	2	2	2	2	3	2	2
CO4	3	2	3	3	2	2	2	2	3	3	3	3
CO5	3	2	3	3	2	2	2	2	2	2	3	3
<b>Total</b>	15	10	15	15	10	10	10	12	12	13	13	14
<b>Average</b>	3	2	3	3	2	2	2	2.4	2.4	2.6	2.6	2.8

3 - Strong; 2 - Medium; 1-Low

**SEMESTER II**  
**ELECTIVE COURSE IV: a) RESEARCH METHODOLOGY**

Course Code	L	T	P	S	Credits	Inst. Hours	Total hours	Marks		
								CIA	External	Total
ZP232EC4	2	1		1	3	4	60	25	75	100

**Pre-requisite**

Students should have a good understanding of the fundamental methods used in experimental biology.

**Learning Objectives**

1. To impart knowledge on the basic principle, methodologies and applications of instruments in biological sciences.
2. Develop essential research skills to operate and apply various biological science instruments.

**Course Outcomes**

On the successful completion of the course, students will be able to:		
1.	recall the principles of laboratory equipments, research techniques and the process of scientific report writing.	<b>K1</b>
2.	Explain the procedures involved in operating laboratory equipment, applying research techniques, and engaging in scientific writing.	<b>K2</b>
3.	apply biological techniques in laboratory settings to gain practical experience in research processes and scientific report writing.	<b>K3</b>
4.	analyze the principles and techniques to make wise choices in experimental design, data interpretation, and research reports in biological sciences.	<b>K4</b>
5	evaluate the quality, reliability, and limitations of data generated by research techniques and obtained from literature for specific research goals.	<b>K5</b>

**K1** - Remember; **K2** - Understand; **K3** – Apply; **K4** – Analyse; **K5** - Evaluate

Units	Contents	No. of hours
I	Analytical Techniques: Good laboratory practice (GLP), pH meter, Colorimeter, Spectrophotometer - UV-Visible, Atomic Absorption, Flame photometer, FTIR spectrometry.	12
II	Microscopy & Micro technique: Principle, Working mechanism and applications of Bright field, Phase contrast, Electron, Confocal Microscope and Atomic force microscope. Histology – Fixation, Sectioning and Staining. Histochemistry for carbohydrates, proteins, lipids.	12
III	Separation Techniques: Centrifugation – Differential and Density gradient, types and applications of Centrifuges. Chromatography - Principle, HPLC and Affinity chromatography, GAS Chromatography Mass Spectrometry. Electrophoresis - Principle, Agarose gel electrophoresis and PAGE.	12
IV	Tracer techniques: Radioactive isotopes, Radiolabeling, Radiocarbon dating, Radio activity counters - Scintillation Counter, Geiger Muller Counter.	12
V	Scientific Writing: Essential steps in research, Review of literature, Literature citation, Research report – Abstract, Tables - Figures - Formatting and typing, Open access journals, Predatory journals, Impact factor, Citation index, H-index, Plagiarism, Copy Right.	12

<b>Self-study</b>	Principle, Working mechanism and applications of Electron and Phase contrast Microscope, Centrifugation - Principle, types and applications of Centrifuges, Bioinstrumentation of pH meter, Colorimeter, and UV-Visible
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Spectrophotometer, Quantification of carbohydrate, protein, lipid, Essential steps in research.
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### Textbooks

1. Veerakumari. L, 2006. *Bioinstrumentation*. MJP Publishers. Triplicane, Chennai.
2. Gurumani. N, 2006. *Research Methodology for Biological Sciences*. MJP Publishers. Triplicane, Chennai

### Reference Books

1. Marimuthu. R, 2008. *Microscopy and Microtechnique*. MJP Publishers. Chennai.
2. Keith Wilson and John Walker, 2018. *Principles and Techniques of Practical Biochemistry* (8<sup>th</sup> ed.). Cambridge University Press. India.
3. Pranav Kumar, 2018. *Fundamentals and Techniques of Biophysics and Molecular Biology*. Pathfinder publication. India.
4. Paneerselvam R, 2016. *Research Methodology*. PHI Learning Pvt. Ltd. India.
5. Gurumani N, 2010. *Scientific thesis writing and paper presentation*. MJP Publishers. Chennai

### Web Resources

1. <https://en.wikipedia.org/wiki/Microtechnique>
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5206469/>
3. <https://www.vedantu.com/physics/spectroscopy>
4. [https://en.wikipedia.org/wiki/Blot\\_\(biology\)](https://en.wikipedia.org/wiki/Blot_(biology))
5. [https://en.wikipedia.org/wiki/List\\_of\\_research\\_methods\\_in\\_biology](https://en.wikipedia.org/wiki/List_of_research_methods_in_biology)

## MAPPING WITH PROGRAMME OUTCOMES MAPPING WITH PROGRAMME SPECIFIC OUTCOMES

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	2	3	2	3	3	2	3	2
CO2	3	1	1	3	2	3	2	3	3	2	2	3
CO3	3	2	1	2	2	2	2	2	2	3	2	2
CO4	3	1	1	3	1	3	2	3	3	3	3	3
CO5	3	2	1	2	3	3	2	2	3	2	2	2
<b>Total</b>	15	8	5	13	10	14	10	13	14	12	12	12
<b>Average</b>	3	1.6	1	2.6	2	2.8	2	2.6	2.8	2.4	2.4	2.4

**3 -Strong; 2 -Medium; 1 -Low**



## SEMESTER II

### ELECTIVE COURSE IV: b) APICULTURE

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP232EC5	3	1	-	-	3	4	60	25	75	100

#### Pre-requisite

Students should be aware of importance of honey bees and their impacts on the ecosystem.

#### Learning Objectives

1. Impart knowledge on the morphology, life cycle, characteristics of honey bees and bee keeping.
2. Acquired skills to perform bee keeping from managing colonies of bees to harvest honey and other bee related by-products in different setups and as an Entrepreneurial venture.

#### Course Outcomes

<b>On the successful completion of the course, students will be able to:</b>		
1.	understand the morphology, life cycle, characteristics of honey bees and bee keeping.	<b>K1</b>
2.	acquire skills to perform bee keeping from managing colonies of bees in order to harvest honey and other Bee related by-products in different setups and as an Entrepreneurial venture.	<b>K2</b>
3.	knowledge on the harvesting, preserving and processing of bee products and identification of the appropriate markets to sell the produce.	<b>K3</b>
4.	identify of different bee enemies and diseases and control measures and its management	<b>K4</b>
5.	evaluate the honey chemical composition of different environment.	<b>K5</b>

**K1** - Remember; **K2** - Understand; **K3** – Apply; **K4**-Analyze **K5**-Evaluate

Units	Contents	No. of Hours
I	Introduction to Apiculture. Scope and importance. History, classification, types of honey bees - morphology, mouth parts and sting of Honey bees – life cycle of different species and their behavioural patterns. Social organization of bee colony. morphology, mouth parts and sting of Honey bees –	12
II	Bee-keeping system, tools and equipment's needed for bee keeping. Types of bee hives, structure, and functional features. Criteria for site selection for apiculture and factors affecting them. Flora for apiculture – selection of Bees for apiculture, Method of bee keeping.	12
III	Identification and Preventive measures to be taken against pests (The Greater wax moth & Wasps and Hornets) and parasites (tracheal mite). Diseases (Nosema disease, Sac-brood disease, European foulbrood disease), and their control measures. Colony collapse disorder and its management.	12
IV	Bee products, uses and importance- Honey, Royal jelly, Propolis, Pollen and Bee venom. Harvesting, Processing, Packaging and Marketing of bee products.	12
V	Apiculture industry around the world and Role of Central Bee Research & Training institute in India. Apiculture as an Entrepreneurial venture.	12

<b>Self-study</b>	Introduction to Apiculture. History, classification, types, life Cycle, Tools and equipment's needed for bee keeping, Diseases affecting honey bees and their control measures. Bee products, uses and importance- Honey, Royal jelly, Propolis, Pollen and Bee venom.
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### Text book

1. Singh, D., Singh, D. Pratap. 2006. *A Handbook of Beekeeping*. Agrobios, India.
2. Mishra R.C. 2002. *Perspectives in Indian Apiculture*, Agrobios, India.

### Reference Books

1. Dharam P. Abrol, 2019. *Beekeeping: A compressive guide to bees and beekeeping*. Scientific Publishers. Jodhpur, India.
2. Caron, D.W, 2013 (revised from 1999). *Honey Bee Biology and Beekeeping*. Wicwas Press. United States.
3. Dewey M. Caron, Lawrence John Connor, 2013. *Honey Bee Biology and Beekeeping*, Revised Hardcover. Wicwas Press. United States.
4. Ross Conrad, Gary Paul Nabhan, 2007. *Natural Beekeeping: Organic Approaches to Modern Apiculture*. Chelsea Green Publishing. United States.
5. Alphonse Avitabile, Jan Propst, 1998. *The Beekeeper's Handbook*. Comstock Pub. Associates. Cornell University Press.

### Web Resources

1. <https://www.britannica.com/topic/beekeeping>
2. <https://nbb.gov.in/pdf/Pests&DiseasesHoneybees&Management.pdf>
3. <https://www.aakash.ac.in/important-concepts/biology/apiculture-in-indian>
4. <https://vikaspedia.in/agriculture/farm-based-enterprises/bee-keeping-1/about-bee-keeping>
5. <https://beebuilt.com/pages/beekeeping-for-beginners>

### MAPPING WITH PROGRAMME OUTCOMES PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	2	1	2	2	2	3	3	2	2	3	2	2
<b>CO2</b>	3	1	2	2	1	3	2	2	2	3	2	2
<b>CO3</b>	3	2	2	2	2	2	1	2	2	3	2	2
<b>CO4</b>	2	3	3	2	2	3	3	2	3	3	2	2
<b>CO5</b>	3	2	3	2	3	2	3	2	3	3	2	2
<b>TOTAL</b>	13	9	12	10	10	13	12	10	12	15	10	10
<b>AVERAGE</b>	2.6	1.8	2.4	2	2	2.6	2.4	2	2.4	3	2	2

**3 – Strong, 2- Medium, 1- Low**

## SEMESTER II

### ELECTIVE COURSE – IV: c) SERICULTURE

Course Code	L	T	P	S	Credits	Inst. Hours	Total hours	Marks		
								CIA	External	Total
ZP232EC6	2	1		1	3	4	60	25	75	100

#### Pre-requisite:

Students should have a fundamental knowledge of biology, an entrepreneurial mindset, and an appreciation for the economic and cultural significance of sericulture.

#### Learning Objectives:

1. To gain in-depth knowledge of silk fiber types, sources, properties, and the significance of sericulture in India.
2. To develop practical skills in moriculture, silkworm rearing, and cocoon processing.

#### Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recall and describe the fundamental concepts, terminology, and processes related to sericulture, and sericulture industry practices.	<b>K1</b>
2.	demonstrate the key concepts, processes, properties of silk fiber, mulberry cultivation techniques, cocoon characteristics, and the significance of sericulture practices in the silk production industry.	<b>K2</b>
3.	apply their knowledge of sericulture principles and practices to solve practical problems and optimizing cocoon processing techniques.	<b>K3</b>
4.	critically analyze the challenges and opportunities in the sericulture industry and assess the economic and environmental implications of sericulture practices.	<b>K4</b>
5.	evaluate the effectiveness of different sericulture practices, technologies, and policies, and make informed decisions to optimize silk production.	<b>K5</b>

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Unit	Contents	No. of hours
I	Introduction to textile fibers; types - natural and synthetic fibers; sources of silk fiber - Tasar, Muga, Anaphe, Gonometa, Fagara, spider and mussel; properties and importance of silk fiber. History, development, status, characteristics, and advantages of sericulture in India.	12
II	Host plants; Moriculture - distribution, morphology, propagation- seedling, cutting, grafting, layering and micropropagation methods, maintenance- irrigation, manuring and pruning, pests and diseases of mulberry.	12
III	<i>Bombyx mori</i> - morphology, anatomy, life cycle, geographical locations, larval moults, voltinism, indigenous and commercial races. Diapause. Egg-storage and transportation.	12
IV	Rearing houses and equipment. Rearing operations- disinfection, brushing, feeding and spacing. Moulting and spinning. Harvest. Rearing methods- chawki, lasso, showa, shelf-rearing, floor-rearing and shoot rearing. Diseases of <i>Bombyx mori</i> - protozoan, bacterial, viral and fungal. Pests of silkworm- Uzi fly, dermestids, mites, ants, nematodes, aves and mammals.	12
V	Physical and commercial characteristics of cocoons. Cocoon harvesting and marketing. Cocoon sorting, stifling, deflossing, riddling, cooking, brushing, reeling and re-reeling. Weaving. By-products of sericulture industry.	12

<b>Self-study</b>	Sources of silk fiber - Tasar, Muga, Anaphe, Gonometa, Fagara, spider and mussel.
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**Textbooks**

1. Ganga, G and J. Sulochana Chetty, 2019. An Introduction to sericulture (2<sup>nd</sup> edn). Oxford and IBH Pub. Co. Pvt. Ltd., Delhi.
2. Johnson, M. and Kesary, M, 2019. Sericulture. Saras publications, Nagercoil.

**Reference Books**

1. Food and Agriculture organization 1976. Manual on sericulture I, II & III. Delhi: Oxford and IBH Pub. Co. Pvt. Ltd., Delhi.
2. M.S. Jolly, 1987. Appropriate Sericulture Techniques. CSR & TI, Mysore
3. S.R. Ullal and M.N. Narasimhanna, 1987. Hand book of practical sericulture. CSB, Bangalore.
4. M.N. Narasimhanna, 1988. Manual on silkworm egg production. CSB, Bangalore.
5. Dandin, S.B., Jayaswal, J. and Giridhar. K, 2010. Handbook of sericulture technologies, Central Silk Board, Bangalore, India.

**Web Resources**

1. <https://agritech.tnau.ac.in/sericulture/>
2. <https://csb.gov.in/>
3. <https://silks.csb.gov.in/>
4. <https://www.britannica.com/topic/sericulture>
5. [https://agritech.tnau.ac.in/sericulture/seri\\_index.html](https://agritech.tnau.ac.in/sericulture/seri_index.html)
6. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/sericulture>
7. <https://vikaspedia.in/agriculture/farm-based-enterprises/sericulture/sericulture-in-india>

**MAPPING WITH PROGRAMME OUTCOMES  
AND PROGRAMME SPECIFIC OUTCOMES**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	2	1	1	1	1	1	2	1	1	3	1	1
CO 2	2	2	1	1	1	1	2	1	1	3	1	1
CO 3	3	2	1	1	1	1	2	1	1	3	1	1
CO 4	3	3	1	1	1	1	2	1	1	3	1	1
CO 5	3	3	1	1	1	1	2	1	1	3	1	1
TOTAL	13	11	5	5	5	5	10	5	5	15	5	5
AVERAGE	2.6	2.2	1	1	1	1	2	1	1	3	1	1

**3 – Strong, 2 – Medium, 1 - Low**

**SEMESTER II**  
**ELECTIVE LAB COURSE -II: ECONOMIC ENTOMOLOGY &**  
**RESEARCH METHODOLOGY**

Course Code	L	T	P	S	Credits	Inst. Hours	Total hours	Marks		
								CIA	External	Total
ZP232EP1	2	1		1	3	2	30	25	75	100

**Pre-requisite:**

Students should have knowledge relevant to economic entomology & research methodology.

**Learning Objectives:**

1. To equip students with skills in both the practical aspects of economic entomology and the essential research methodology.
2. To acquire skills necessary for conducting meaningful studies in these field.

**Course Outcomes**

On the successful completion of the course, students will be able to:		
1.	comprehend the principles and concepts of economic entomology & research methodology.	K1
2.	summarize the economic impact of insect pests. explain the principles behind different techniques & research designs	K2
3.	utilize appropriate methodologies to collect and analyze data of insects and apply statistical techniques to interpret and draw conclusions.	K3
4.	interpret practical solutions to address challenges in economic entomology, incorporating research methodology principles.	K4
5.	evaluate research methodologies and experimental designs used in economic entomology studies.	K5

**K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate;

**Economic Entomology**

1. Collect and identify common insect pests in your local environment.
2. Dissection: Silk glands of silkworm.
3. Mounting: Mouth parts of honey bee. Mosquito.
4. Phototactic behavior of insect pests.
5. Collection and Identification of insect pests in the mulberry plants.

**Specimen/Spotters/Models:** Silk worm larva, pupa and adult, honey bee colony, Rhinoceros beetle, Red Palm Weevil, Banana Stem Weevil.

**Research Methodology**

1. Whole mount preparation of two specimens.
2. Separation of amino acids using thin layer chromatography.
3. Sectioning and staining of a tissue.
4. Separation of pigments by column chromatography using plant extract (Demonstration).
5. Agarose Gel electrophoresis (Demonstration).

**Instruments/ Charts/ Models:** Phase contrast microscope, fluorescent microscope, spectrophotometer, HPLC, flame photometer, microtome, electrophoretic apparatus.

**Textbooks**

1. Bajia, R., R.N. Kencharaddi, B. Bairwa, K. Kumar, V. Kumar. *Practical handbook on fundamentals of entomology*. Second edition. Kalyani Publishers. Chennai.
2. Gurumani N, 2019. *Research Methodology: For Biological Sciences*. Kindle Edition. Chennai.

## Reference Books

1. Trigunayat, M.M, 2016. *A Manual of Practical Entomology*. 3rd Ed. Scientific Publishers. Jodhpur, Rajasthan.
2. Agrawal, N, 2022. *Fundamental Entomology: A Practical Manual*. Narendra Publishing House, New Delhi.
3. Ch Raja Goud, 2022. *Practical Manual on Fundamentals of Entomology*. Om Publishers. New Delhi
4. Vinayak Bairagi & Mousami Vaibhav Munot, 2019. *Research Methodology: A Practical and Scientific Approach*. CRC press. Florida, United States.
5. Catherine Dawson, 2002. *Practical Research Methods: A User-Friendly Guide to Mastering Research Techniques and Projects*. Ubs Publishers' Distributors Pvt.Ltd. Ernakulam, Kerala.

## Web Resources

1. [https://www.researchgate.net/publication/327282644\\_A\\_Textbook\\_of\\_Economic\\_Entomology\\_M\\_Dayib](https://www.researchgate.net/publication/327282644_A_Textbook_of_Economic_Entomology_M_Dayib)
2. <https://academic-accelerator.com/encyclopedia/economic-entomology>
3. [https://books.google.co.in/books?id=z2s6nQAACAAJ&printsec=frontcover&source=gbs\\_ge\\_summary\\_r&cad=0#v=onepage&q&f=false](https://books.google.co.in/books?id=z2s6nQAACAAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false)
4. <https://jru.edu.in/studentcorner/labmanual/agriculture/Insect%20morphology%20and%20%20systematics.pdf>
5. <https://www.scribbr.com/dissertation/methodology/>

### MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO2	PSO3	PSO4	PSO5
CO 1	1	1	1	1	1	1	2	1	1	2	1	1
CO 2	1	1	1	1	1	1	2	1	1	2	2	1
CO 3	2	1	1	1	2	1	2	1	1	3	2	2
CO 4	3	2	2	2	1	3	2	1	1	3	1	3
CO 5	3	2	2	3	3	1	2	1	2	3	3	3
TOTAL	10	7	7	8	5	7	10	5	6	13	9	10
AVERAGE	2.6	2.2	2.2	2.4	1.4	2.2	2	1.4	1.6	2.4	1.8	2.6

3 – Strong, 2 – Medium, 1 - Low

**SEMESTER II**  
**SKILL ENHANCEMENT COURSE I: POULTRY FARMING**

Course Code	L	T	P	S	Credits	Inst. Hours	Total hours	Marks		
								CIA	External	Total
ZP232SE1	2	1		1	2	4	60	25	75	100

**Pre-requisite**

Students should be aware of economic and cultural importance of Poultry farming.

**Learning Objectives:**

1. To know the needs for Poultry farming and the status of India in global market.
2. Acquire the skills to apply the techniques and practices needed or Poultry farming.

**Course Outcomes:**

<b>On the successful completion of the course, students will be able to:</b>		
<b>1.</b>	recall the key components of a poultry house to ensure optimal living conditions for poultry.	<b>K1</b>
<b>2.</b>	explain the different methods of rearing and the significance of proper vaccination programs in poultry farming.	<b>K2</b>
<b>3.</b>	develop a practical feeding plan for a specific stage of poultry considering their nutritional requirements.	<b>K3</b>
<b>4.</b>	analyze the impact of different housing systems on poultry welfare and productivity,	<b>K4</b>
<b>5.</b>	critically assess the effectiveness of poultry feeds and the disease control measures in poultry farming,	<b>K5</b>
<b>6.</b>	design a comprehensive waste management and recycling system for poultry farms.	<b>K6</b>

**K1- Remember; K2- Understand; K3- Apply; K4-Analyze; K5-Evaluate; K6- Create**

<b>Unit</b>	<b>Contents</b>	<b>No. of hours</b>
<b>I</b>	General introduction to poultry farming - Definition of Poultry - Past and present scenario of poultry industry in India - Principles of poultry housing - Poultry houses - Systems of poultry farming	12
<b>II</b>	Management of chicks - growers and layers - Management of Broilers. - Preparation of project report for banking and insurance.	12
<b>III</b>	Poultry feed management-Principles of feeding, Nutrient requirements for different stages of layers and broilers - Feed formulation and Methods of feeding.	12
<b>IV</b>	Poultry diseases-viral, bacterial, fungal and parasitic (two each); symptoms, control and management; Vaccination programme.	12
<b>V</b>	Selection, care and handling of hatching eggs - Egg testing. Methods of hatching. - Brooding and rearing -. Sexing of chicks. - Farm and Water Hygiene - Recycling of poultry waste.	12

**Text Books**

1. Sreenivasaiah., P. V, 2015. *Textbook of Poultry Science*. 1st Edition. Write & Print Publications, New Delhi.
2. Jull A. Morley, 2007. *Successful Poultry Management*. 2nd Edition. Biotech Books, New Delhi.

## Reference Books

1. Jadhav, J, Siddique, M.F., Kavitha Meena, 2019. *Handbook of Poultry Production and Management*. 3rd Edition. Jaypee Brothers Medical Publishers, Chennai.
2. Jagdish Prasad, 2015. *Poultry Production and Management Paperback – 1*. 5h Edition Kalyani Publishers, Chennai.
3. Das, D, 2021. *Textbook on Poultry Management*. Narendra Publishing House, New Delhi.
4. Eiri Board, 2008. *Hand Book of Poultry Farming and Feed Formulations*. Engineers India Research Institute. India.
5. Sharma R P et al. *Poultry Production in India*. Poultry Science, India.

## Web Resources

1. <https://dahd.nic.in/sites/default/files/Excerpts%20of%20Poultry%20Farmn%20Manual.pdf>
2. <https://www.fao.org/3/i3531e/i3531e.pdf>
3. <https://egyankosh.ac.in/bitstream/123456789/59735/1/Poultry%20farming%20in%20india.pdf>
4. <https://seyianwo.files.wordpress.com/2015/04/poultry-lecture-note.pdf>
5. [https://surendranathcollege.ac.in/new/upload/SUMAN\\_TAMANGPoultry%20Farming2021-02-14Poultry%20Farming-converted.pdf](https://surendranathcollege.ac.in/new/upload/SUMAN_TAMANGPoultry%20Farming2021-02-14Poultry%20Farming-converted.pdf)

### MAPPING WITH PROGRAMME OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	1	2	2	2	2	1	1	3	3	3
CO2	1	1	2	3	1	2	2	1	2	2	1	2
CO3	2	1	2	2	1	3	2	1	2	2	2	2
CO4	3	2	1	2	1	2	1	2	2	1	1	1
CO5	1	2	2	2	2	2	3	2	3	2	2	3
CO6	2	3	3	2	3	3	3	3	2	3	2	2
Total	13	11	11	14	10	14	13	10	12	13	11	13
Average	2.1	1.8	1.8	2.3	1.6	2.3	2.1	1.6	2	2.1	1.8	2.1

3 - Strong; 2 - Medium; 1-Low



**SEMESTER – I & II**  
**LIFE SKILL TRAINING – I ETHICS**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PG23LST1	1				1	1	1	-	50	100

**Prerequisites:** Value education-its purpose and significance in the present world

**Learning Objectives**

- To familiarize students with values of the individual, society, culture, one's own health and life philosophy,
- To impart knowledge of professional ethical standards, codes of ethics, obligations, safety, rights, and other worldwide challenges.

Course Outcomes	On completion of this course the student will be able to	
CO1	understand deeper insight of the meaning of their existence.	K1
CO2	recognize the philosophy of life and individual qualities	K2
CO3	acquire the skills required for a successful personal and professional life.	K3
CO4	develop as socially responsible citizens.	K4
CO5	create a peaceful, communal community and embrace unity.	K3

Unit	Contents	No. of Hours
I	<b>Goal Setting:</b> Definition - Brainstorming Session – Setting Goals – Few components of setting goals.	3
II	<b>Group Dynamics:</b> Definition - Nature of Groups – Types of Groups – Determinants of group behavior	3
III	<b>Conflict Resolution:</b> Definition – What is a conflict resolution – Why should conflicts be resolved? - Lessons for life	3
IV	<b>Decision Making:</b> Definition – 3C's of decision making – Seven Steps to effective decision making – Barriers in effective decision making	3
V	<b>Anger Management:</b> Effects of anger – Tips to reduce anger – Anger warning signs – Identify your triggers – Ways to cool down your anger.	3
<b>TOTAL</b>		<b>15</b>
<b>Self-Study Portion:</b> Salient values for life, Human Rights, Social Evils and how to tackle them, Holistic living, Duties and responsibilities.		

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## Textbooks

Life Skill Training – I Ethics, Holy Cross College (Autonomous), Nagercoil

## Reference Books

1. Holy Cross College (Autonomous), Nagercoil (2007). Foundation Course Life's Challenges. Sipca Computers.
2. Mathew, Sam (2010). Self Help Life Book. Opus Press Publisher.
3. Swati Mehrotra. (2016). Inspiring Souls Moral Values and Life Skills (1st ed.) [English]. Acevision Publisher Pvt. Ltd.
4. Irai Anbu, v. (2010, August). Random Thoughts (1st ed.) [English]. THG Publishing Private Limited 2019.
5. Holy Cross College (Autonomous), Nagercoil (2007). Foundation Course Life's Challenges. Sipca Computers.

## Web Resources

1. <https://positivepsychology.com/goal-setting-exercises/>
2. [https://www.gov.nl.ca/iet/files/CCB\\_GroupDynamicsGuide.pdf](https://www.gov.nl.ca/iet/files/CCB_GroupDynamicsGuide.pdf)
3. [https://en.wikipedia.org/wiki/Conflict\\_resolution](https://en.wikipedia.org/wiki/Conflict_resolution)
4. <https://asana.com/resources/decision-making-process>
5. <https://www.mayoclinic.org/healthy-lifestyle/adult-health/in-depth/anger-management/art-20045434>