

# M. SC. ZOOLOGY

(based on TANSICHE)

## SYLLABUS

**FROM THE ACADMIC YEAR  
2023-2024**



**RAJAH SERFOJI GOVERNMENT COLLEGE (Autonomous)  
THANJAVUR 613005**

**JULY 2023**

<b>TANSCHER REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION</b>			
<b>Programme</b>	<b>M. Sc. Zoology</b>	<b>Programme Code</b>	
<b>Duration</b>	<b>PG-2 years</b>		
<b>Programme Outcomes (Pos)</b>			
<b>PO-1: Problem Solving Skill</b>	Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.		
<b>PO-2: Decision Making Skill</b>	Foster analytical and critical thinking abilities for data-based decision-making.		
<b>PO3: Ethical Value</b>	Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.		
<b>PO-4: Communication Skill</b>	Ability to develop communication, managerial and interpersonal skills.		
<b>PO-5: Individual and Team Leadership Skill</b>	Capability to lead themselves and the team to achieve organizational goals		
<b>PO-6: Employability Skill</b>	Inculcate contemporary business practices to enhance employability skills in the competitive environment.		
<b>PO-7: Entrepreneurial Skill</b>	Equip with skills and competencies to become an entrepreneur		
<b>PO-8: Contribution to Society</b>	Succeed in career endeavors and contribute significantly to society		
<b>PO -9 Multicultural competence</b>	Possess knowledge of the values and beliefs of multiple cultures and a global perspective		
<b>PO -10: Moral and ethical awareness/reasoning</b>	Ability to embrace moral/ethical values in conducting one's life.		
<b>Programme Specific Outcomes (PSOs)</b>			
<b>PSO-1: Placement</b>	To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.		
<b>PSO-2: Entrepreneur</b>	To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations		
<b>PSO-3: Research and Development</b>	Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development		
<b>PSO-4 Contribution to Business World</b>	To produce employable, ethical and innovative professionals to sustain in the dynamic business world		
<b>PSO-5 Contribution to the Society</b>	To contribute to the development of the society by collaborating with stakeholders for mutual benefit.		

Template for P.G., Programmes

Semester-I	Credit	Hours	Semester-II	Credit	Hours	Semester-III	Credit	Hours	Semester-IV	Credit	Hours
1.1. Core-I	5	7	2.1. Core-IV	5	6	3.1. Core-VII	5	6	4.1. Core-XI	5	6
1.2 Core-II	5	7	2.2 Core-V	5	6	3.2 Core-VIII	5	6	4.2 Core-XII	5	6
1.3 Core - III	4	6	2.3 Core - VI	4	6	3.3 Core - IX	5	6	4.3 Project with viva voce	7	10
1.4 Discipline Centric Elective -I	3	5	2.4 Discipline Centric Elective - III	3	4	3.4 Core - X	4	6	4.4 Elective - VI (Industry / Entrepreneurship)	3	4
1.5 Generic Elective-II:	3	5	2.5 Generic Elective - IV:	3	4	3.5 Discipline Centric Elective - V	3	3	4.5 Skill Enhancement course / Professional Competency Skill	2	4
			2.6 NME I	2	4	3.6 NME II	2	3	4.6 Extension Activity	1	
						3.7 Internship/ Industrial Activity	2	-			
	<b>20</b>	<b>30</b>		<b>22</b>	<b>30</b>		<b>26</b>	<b>30</b>		<b>23</b>	<b>30</b>
<b>Total Credit Points -91</b>											

**Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credits and Hours Distribution System for all Post – Graduate Courses including Lab Hours**

**M. Sc. Zoology-Syllabus**

**First Year : Semester-I**

Sl. No.	List of Courses	Title	Credit	Inst. Hrs.	Exam Hrs.	Marks		Total
						Int	Ext	
01	CC-1 T1PZOC1	Structure and Function of Invertebrates	5	7	3	25	75	100
02	CC-2 T1PZOC2	Comparative Anatomy of Vertebrates	5	7	3	25	75	100
03	CC-3 T1PZOC3	Lab Course in Invertebrates & Vertebrates	4	6		25	75	100
04	EC-1 T1PZOECA	Molecules and their interaction relevant to Biology	3	5	3	25	75	100
05	EC-2 T1PZOECEB	Biostatistics	3	5	3	25	75	100
			<b>20</b>	<b>30</b>				<b>500</b>

**First Year : Semester-II**

01	CC-4 T2PZOC4	Cellular and Molecular Biology	5	6	3	25	75	100
02	CC-5 T2PZOC5	Developmental Biology	5	6	3	25	75	100
03	CC-6 T2PZOC6	Lab Course in Cell Biology and Developmental Biology	4	6	3	25	75	100
04	EC-3 T2PZOECC	Ecology	3	4	3	25	75	100
05	EC-4 T2PZOECD	Research Methodology	3	4	3	25	75	100
06	SEC 1 T2PZOS1	Poultry Farming	2	4	3	25	75	100
			<b>22</b>	<b>30</b>				

**Second Year: Semester-III**

01	CC-7 T3PZOC7	Genetics	5	6	3	25	75	100
02	CC-8 T3PZOC8	Evolution	5	6	3	25	75	100
03	CC-9 T3PZOC9	Animal Physiology	5	6	3	25	75	100
04	CC-10 T3PZOC10	Medical Laboratory Techniques	4	6	3	25	75	100
05	EC -5 T3PZOECE	Lab Course in Genetics, Evolution and Animal	3	3	3	25	75	100

		Physiology						
06	SEC-2 T3PZOS2	Apiculture	2	3	3	25	75	100
07	Internship / Industrial Activity		2	-				--
			<b>26</b>	<b>30</b>				<b>600</b>
<b>Second Year: Semester-IV</b>								
01	CC-11 T4PZOC11	Immunology	5	6	3	25	75	100
02	CC-12 T4PZOC12	Lab in Immunology	5	6	3	25	75	100
03	CC-13 T4PZOC13 Project with VIVA VOCE		7	10				100
04	EC-6 T4PZOECF	Aquaculture	3	4	3	25	75	100
05	SEC-2 T4PZOS3	Intellectual Properties Rights	2	4	3	25	75	100
06	Extension Activity		1					
			<b>23</b>	<b>30</b>				<b>500</b>

  
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## Structure and Function of Invertebrates

### Course Objectives:

The main objectives of this course are:

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

<b>Course I</b>	:	<b>Core I</b>	<b>Code</b>	<b>T1PZOC1</b>
<b>Course title</b>	:	<b>Structure and Function of Invertebrates</b>		
<b>Credits</b>	:	<b>5</b>	<b>Hours/Week</b>	<b>7</b>

### Pre-requisite:

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

### Expected Course Outcome:

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

1.	Remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.	<b>K1 &amp; K2</b>
2.	Understand the evolutionary process. All are linked in a sequence of life patterns.	<b>K2 &amp; K4</b>
3.	Apply this for pre-professional work in agriculture and conservation of life forms.	<b>K3 &amp; K5</b>
4.	Analyze what lies beyond our present knowledge of life process.	<b>K4 &amp; K6</b>
5.	Evaluate and to create the perfect phylogenetic relationship in classification.	<b>K5 &amp; K6</b>

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

### Units

<b>I</b>	Structure and function in invertebrates: Principles of Animal taxonomy; Species concept; International code of zoological nomenclature; Taxonomic procedures; New trends in taxonomy
<b>II</b>	Organization of coelom: Acoelomates; Pseudocoelomates; Coelomates: Protostomia and Deuterostomia; Locomotion: Flagella and ciliary movement in Protozoa; Hydrostatic movement in Coelenterata, Annelida and Echinodermata
<b>III</b>	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>IV</b>	Excretion: Organs of excretion: coelom, coelomoducts, Nephridia and Malphigian 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>V</b>	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

#### Reading list

1. Barrington, E. J.W. 1979. Invertebrate Structure and Function. The English Language Book Society and Nelson, pp-765.

#### Recommended texts

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.

#### Mapping with Programme Outcomes\*

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

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



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<b>Comparative Anatomy of Vertebrates</b>			
<b>Course Objectives:</b>			
The main objectives of this course are:			
1.	Exemplifying the vertebrate origin and the intermediary position of Prochordates between invertebrates and vertebrates.		
2.	Acquires the knowledge on evolution and adaptive radiation of Agnatha and Pisces.		
3.	Understanding knowledge about the first terrestrial vertebrates and the adaptive radiation of land animals		
4.	Imparting conceptual knowledge about the animal life in the air and their behaviours.		
5.	Understanding the origin and efficiency of mammals and evolutionary changes that occurred in the life of vertebrates.		
Course I	:	Core II	Code T1PZOC2
Course title	:	Comparative Anatomy of Vertebrates	
Credits	:	5	Hours/Week 7
<b>Pre-requisite:</b>			
Students with knowledge and comprehension on zoology.			
<b>Expected Course Outcome:</b>			
On the successful completion of the course, student will be able to:			
1.	Remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.	K1 & K2	
2.	Understand the evolutionary process. All are linked in a sequence of life patterns.	K2 & K4	
3.	Apply this for pre-professional work in agriculture and conservation of life forms.	K3 & K5	
4.	Analyze what lies beyond our present knowledge of life process.	K4 & K6	
5.	Evaluate and to create the perfect phylogenetic relationship in classification.	K5 & K6	

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

<b>Units</b>	<b>Contents</b>
<b>I</b>	Origin of vertebrates: Concept of Protochordata; The nature of vertebrate morphology; Definition, scope and relation to other disciplines; Importance of the study of vertebrate morphology.
<b>II</b>	Origin and classification of vertebrates: Vertebrate integument and its derivatives. Development, general structure and functions of skin and its derivatives; Glands, scales, horns, claws, nails, hoofs, feathers and hairs.
<b>III</b>	General plan of circulation in various groups: Blood; Evolution of heart: Evolution of

	aortic arches and portal systems. Respiratory system: Characters of respiratory tissue; Internal and external respiration; Comparative account of respiratory organs
IV	Skeletal system: 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.
V	Sense organs: Simple receptors; Organs of Olfaction and taste; Lateral line system; Electroreception. Nervous system: Comparative anatomy of the brain in relation to its functions; Comparative anatomy of spinal cord; Nerves-Cranial, Peripheral and Autonomous nervous systems.

### Reading list

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

### Recommended texts

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


### Mapping with Programme Outcomes\*

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

\*S - Strong; M - Medium; L – Low



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Lab Course in Invertebrates, Vertebrates & Biomolecules				
<b>Course Objectives:</b>				
The main objectives of this course are:				
1.	Understanding the different systems in invertebrates & vertebrates.			
2.	Learning about various animal species, their phylogenetic affinities and their adaptive features			
3.	Imparting conceptual knowledge about the salient features and functional anatomy.			
4.	Developing the skill in mounting techniques of the biological samples.			
5.	Gaining fundamental knowledge on the skeletal system			
Course I	:	Core III	Code	T1PZOC3
Course title	:	Lab Course in Invertebrates, Vertebrates & Biomolecules		
Credits	:	4	Hours/Week	6
<b>Pre-requisite:</b>				
Basic knowledge on the animals living in different habitats				
<b>Expected Course Outcome:</b>				
On the successful completion of the course, student will be able to:				
1.	Understand the structure and functions of various systems in animals	K2 & K4		
2.	Learn the adaptive features of different groups of animals	K1 & K2		
3.	Learn the mounting techniques	K2 & K3		
4.	Acquire strong knowledge on the animal skeletal system	K2 & K4		

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

### INVERTEBRATES

#### Dissection

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

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

1. *Amoeba*
2. *Entamoeba histolytica*
3. *Paramecium*
4. *Hydra* with bud
5. Sporocyst – Liver fluke
6. *Cercaria* larva
7. *Tape worm (Scolex)*

8. *Ascaris* T. S.
9. Mysis of prawn

### Spotters

1. Scorpion
2. *Penaeus indicus*
3. *Emerita (Hippa)*
4. *Perna viridis*

### Mounting

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

## CHORDATES

### Study the nervous system of Indian dog shark - Dissection

1. Nervous system of *Scoliodon laticaudatus* – 5<sup>th</sup> or Trigeminal nerve
2. Nervous system of *Scoliodon laticaudatus* – 7<sup>th</sup> or Facial nerve
3. Nervous system of *Scoliodon laticaudatus* – 9<sup>th</sup> and 10<sup>th</sup>  
or Glossopharyngeal & Vagus nerve

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

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

### Study of the different types of scales in fishes

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

### Study of the frog skeleton system (Representative samples)

1. Entire skeleton

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

### Mounting

1. Weberian ossicles of fish

### Biochemistry

1. Quantification of Carbohydrates
2. Quantification of Protein
3. Quantification of Lipids

### Spotters

Amino Acid Structure, Colorimeter, pH meter,

### 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. Chattopadhyay. 2011. Advanced Practical Zoology, Arunabha Sen Publishers, pp-1070.

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	M	S	M	S
CO2	S	M	L	S	M	S	M	M	M	M
CO3	M	M	L	S	L	S	M	L	M	M
CO4	S	S	L	S	L	S	M	L	M	L
CO5	S	S	M	L	M	S	M	S	M	M

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

  
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Molecules and their interaction relevant to Biology					
<b>Course Objectives:</b>					
The main objectives of this course are:					
1.	Students should know the fundamentals of biochemistry				
<b>Course</b>	<b>Elective I</b>				
<b>Course title</b>	<b>Molecules and their interaction relevant to Biology</b>				
<b>Credits</b>	<b>3</b>	<b>Hr/Week</b>	<b>5</b>	<b>Course Code</b>	<b>TPZOECA</b>
<b>Pre-requisite:</b>					
Understanding fundamental properties of elements, atoms, molecules, chemical bonds, linkages and structure, composition, metabolism and functions of biomolecules.					
<b>Expected Course Outcome:</b>					
On the successful completion of the course, student will be able to:					
I	Learn the structure, properties, metabolism and bioenergetics of biomolecules			<b>K1</b>	<b>&amp; K3</b>
II	Acquire knowledge on various classes and major types of enzymes, classification, their mechanism of action and regulation			<b>K1</b>	<b>&amp; K2</b>
III	Understand the fundamentals of biophysical chemistry and biochemistry, importance and applications of methods in conforming the structure of biopolymers			<b>K2</b>	<b>&amp; K3</b>
IV	Comprehend the structural organization of and proteins, carbohydrates, nucleic acids and lipids			<b>K2</b>	<b>&amp; K4</b>
V	Familiarize the use of methods for the identification, characterization and conformation of biopolymer structures			<b>K5</b>	<b>&amp; K6</b>

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

Units	
<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).
<b>II</b>	Biomolecular interactions and their properties: Stabilizing interactions (Vander Waals, electrostatic, hydrogen bonding, hydrophobic interaction etc. - Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).
<b>III</b>	Bioenergetics and enzymology: Bioenergetics, glycolysis, Krebs's Cycle, Amino Acid Catabolism. Oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers - Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isoenzymes
<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).
V	Stabilizing interactions in biomolecules: Stability of protein and nucleic acid structures - hydrogen bonding, covalent bonding, hydrophobic interactions and disulfide linkage.

#### Reading list


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


#### Recommended texts

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.

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	S	L	S	M	S	M	M
CO2	S	S	L	S	S	S	M	M	M	S
CO3	M	M	M	S	M	S	S	S	S	L
CO4	S	M	S	M	S	M	S	S	S	M
CO5	M	S	S	M	M	S	M	L	S	M

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

  
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BIOSTATISTICS			
<b>Course Objectives:</b>			
The main objectives of this course are:			
<b>1.</b>	Students should know basic concepts in Biostatistics.		
<b>Course I</b>	<b>Elective II</b>	<b>Course Code</b>	<b>TPZOEBC</b>
<b>Course title</b>	<b>Biostatistics</b>		
<b>Credits</b>	<b>3</b>	<b>Hours/Week</b>	<b>5</b>
<b>Pre-requisite:</b>			
Students should be aware of importance of analysis of quantitative and qualitative information from biological studies.			
<b>Expected Course Outcome:</b>			
Upon completion of this course, Students would have			
I	Clear understanding of design and application of biostatistics relevant to experimental and population studies.		<b>K2 &amp; K3</b>
II	Acquired skills to perform various statistical analyses using modern statistical techniques and software.		<b>K3 &amp; K4</b>
III	Knowledge on the merits and limitation of practical problems in biological/ health management study as well as to propose and implement appropriate statistical design/ methods of analysis.		<b>K5 &amp; K6</b>

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

Units	
<b>I</b>	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.
<b>II</b>	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.
<b>III</b>	Probability: Theories and rules; Probability - Addition and multiplication theorem; Probability distribution: Properties and application of Normal, Binomial and Poisson distributions.
<b>IV</b>	Hypothesis testing: Student't' test - paired sample and mean difference't' tests. Correlation: Types - Karl Pearsons Co-efficient, Rank correlation, Significance test for correlation coefficients. Regression analysis: Computation of biological data, calculation of regression co-efficient, graphical representation and prediction.
<b>V</b>	Analysis of variance: one way and two-way. Data analysis with comprehensive statistical software using Statistical Package for the Social Sciences (SPSS).

**Reading list**

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.

**Recommended texts**


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

**Mapping with Programme Outcomes\***

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

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

  
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## Cellular and Molecular Biology

### Course Objectives:

The main objectives of this course are:

1.	To understand the ultra-structure and functions of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles.
2.	To realize involvement of various cellular components in accomplishing cell division.
3.	To enable a successful performance in cell biology component of CSIR-UGC NET.

<b>Course I</b>	:	<b>Core IV</b>	<b>Code</b>	<b>T2PZOC4</b>
<b>Course title</b>	:	<b>Cellular and Molecular Biology</b>		
<b>Credits</b>	:	<b>5</b>	<b>Hours/Week</b>	<b>6</b>

### Pre-requisite:

Students should have knowledge of the basic cellular structures and their salient functions in prokaryotic and eukaryotic cells.

### Expected Course Outcome:

Upon completion of this course, students could

1.	Understand the general concepts of cell and molecular biology.	<b>K2</b>
2.	Visualize the basic molecular processes in prokaryotic and eukaryotic cells, especially relevance of molecular and cellular structures influencing functional features.	<b>K1 &amp; K2</b>
3.	Perceive the importance of physical and chemical signals at the molecular level resulting in modulation of response of cellular responses.	<b>K3 &amp; K4</b>
4.	Updated the knowledge on the rapid advances in cell and molecular biology for a better understanding of onset of various diseases including cancer.	<b>K5</b>
5.	Understand the general concepts of cell and molecular biology.	<b>K2</b>

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

### Units

<b>I</b>	General features of the cell: Basic structure of prokaryotic and eukaryotic cells - Protoplasm and deutroplasm - cell organelles; cell theory; Diversity of cell size and shapes.
<b>II</b>	Cellular organization: Membrane structure and functions - Structure of model membrane, lipid bilayer and membrane proteins diffusion, osmosis, ion channels, active transport, ion pumps, mechanism and regulation of intracellular transport, electrical properties of membranes. Structure and functions of Intracellular organelles: Nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles and chloroplasts.

III	Cell division and Cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle and control of cell cycle. Molecular biology of cell: Structure of DNA and RNA; Process of DNA replication, transcription and translation in pro- and eukaryotic cells; Genetic maps.
IV	Cell communication and cell signaling: Membrane- associated receptors for peptide and steroid hormones - signaling through G-protein coupled receptors, signal transduction pathways. General principles of cell communication: extracellular space and matrix, interaction of cells with other cells and non-cellular structures.
V	Cancer cells: Characteristic features of normal and cancer cells; Carcinogens: types and cancer induction; Metastasis; Oncogenes and tumor suppressor genes, apoptosis; therapeutic interventions of uncontrolled cell growth.

#### Reading list

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

#### Recommended texts


1. Karp, G. 2010. Cell Biology (Sixth Edition), John Wiley & Sons, Singapore, pp-765.
2. Lodish, H., C. A. Kaiser, A. Bretscher, *et al.*, 2013. Molecular Cell Biology (Seventh Edition), Macmillan, England, pp-1154
3. De Robertis, E.D.P. and E. M. F. De Robertis Jr, 1987. Cell and Molecular Biology. Info-Med, Hong Kong, pp-734
4. Abbas, A. K., A. H. Lichtman and S. Pillai, 2007, Cell and Molecular Immunology (Sixth Edition), Saunders, Philadelphia, pp-566
5. Loewy, A.G., P. Siekevitz and J. R. Menninger, *et al.*, 1991, Cell Structure and Function (Third Edition), Saunders, Philadelphia, pp-947
6. Watson, J. D., N.H. Hopkins, J.W. Roberts, *et al.*, 1987, Molecular Biology of the Gene (Fourth Edition), Benjamin/Cummings, California, pp-1163
7. Han, S. S. and J. Holmstedt. 1979, Cell Biology, McGraw Hill, pp-319
8. Alberts, B., A. Johnson, J. Lewis, *et al.*, 2015, Molecular Biology of the Cell (Sixth Edition), Garland Science, New York, pp-1342
9. Clark, D.P., 2005. Molecular Biology, Elsevier, China, pp-784
10. Tropp, B. 2008. Molecular Biology Genes to Proteins (Third Edition), Jones & Bartlett, US, pp-1000

#### Mapping with Programme Outcomes\*

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

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

  
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## Developmental Biology

### Course Objectives:

The main objectives of this course are:

- |    |  |
|----|--|
| 1. | Understand the process of gametogenesis, cleavage and gastrulation, embryonic development, extra embryonic membrane and placenta in various animals and human. |
| 2. | Learn the principles, methods and applications of cryo-preservation of gametes and embryo.   |

<b>Course I</b>	:	<b>Core V</b>	<b>Course Code</b>	<b>T2PZOC5</b>
<b>Course title</b>	:	<b>Developmental Biology</b>		
<b>Credits</b>	:	<b>5</b>	<b>Hours/Week</b>	<b>6</b>
<b>Pre-requisite:</b>				
Students have fundamental knowledge in developmental biology.				
<b>Expected Course Outcome:</b>				
On the successful completion of the course, student will be able to				
1.	Define the concepts of embryonic development	<b>K1</b>		
2.	Observe various stages of cell divisions under microscope	<b>K2 &amp; K3</b>		
3.	Understand the formation of zygote	<b>K4</b>		
4.	Differentiate the blastula and gastrula stages	<b>K4 &amp; K5</b>		
5.	Learn the distinguishing features of three different germ layers and formation of various tissues and organs	<b>K4</b>		

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

### Units

<b>I</b>	Pattern of animal development: Chief events in animal development; History of thoughts and conceptual developments. Gametogenesis: Origin of germ cells, spermatogenesis - Sperm morphology in relation to the type of fertilization, Oogenesis - Oogenesis in insects and amphibians; Composition and synthesis of yolk in invertebrates (insects and crustaceans) and vertebrates; Genetic control of vitellogenin synthesis in amphibians
<b>II</b>	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
<b>III</b>	Cleavage and gastrulation: Pattern of embryonic cleavage, mechanisms of cleavage, mid blastula transition - Determinate and regulatory embryos, Factors affecting gastrulation, mechanisms and types of gastrulation in respective animal embryos (Sea urchin, <i>Amphioxus</i> , Amphibians, Aves, Mammals); Fate maps - (Amphibian and Chick), Epigenesis and preformation – Formation of primary germ layers
<b>IV</b>	Embryonic Development; Embryonic development of fish and birds, formation of extra embryonic membranes in mammalian – Organogenesis - Development of

	endodermal, mesodermal and ectodermal derivatives. Embryonic Induction and neurulation; Formation and migration of neural crest cells - types of neural crest cells and their patterning - primary and secondary neurulation. Gene and development; Anterior- posterior axis in determination in drosophila, Maternal effect genes - <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: Formation of ectodermal cap and regeneration blastema – Types of regeneration in planaria, Regenerative ability in different animal groups, Factors stimulating regeneration – Biochemical changes associated with 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

#### Reading list

1. Balinsky, B. I. 1981. Introduction to Embryology (5<sup>th</sup> Edition), CBS College Publishers, New York, pp-782.
2. Gilbert. S. F. 2006. Developmental Biology, 8<sup>th</sup> Edition, INC Publishers, USA, pp-785.
3. Berrill, N.J. 1974. Developmental Biology, Tata Mc-Graw Hill Publications, New Delhi, pp-535.
4. Tyler, M.S. 2000. Developmental Biology - A Guide for Experimental Study, Sunderland, MA, pp-208.
5. Subramoniam, T. 2011. Molecular Developmental Biology (2<sup>nd</sup> Edition), Narosa Publishers, India, pp-364.
6. [www.easybiologyclass.com](http://www.easybiologyclass.com) > developmental-biology-e
7. [www.studocu.com](http://www.studocu.com) > document > lecture-notes > view
8. [ocw.mit.edu](http://ocw.mit.edu) > courses > 7-22-developmental-biology-f.

#### Recommended texts

1. Wilt, F.H. and N.K. Wessel. 1967. Methods in Developmental Biology, Thomas Y Crowell, New York.
2. Slack J.M.W. 2012. Essential Developmental Biology (3<sup>rd</sup> Edition), Wily-Blackwell Publications, USA, pp-496.
3. Mari-Beffa, M. and J. Knight. 2005. Key Experiments in Practical Developmental Biology, Cambridge University Press, UK, pp-404.

#### Mapping with Programme Outcomes\*

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

\*S - Strong; M - Medium; L – Low

  
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## Lab Course in Cell Biology and Developmental Biology

### Course Objectives:

The main objectives of this course are:

- |           |  |
|-----------|--|
| <b>1.</b> | Practical course aims at demonstrating significant cellular and molecular biological principles, quantitative and analytical approaches that enable the students to translate the theoretical foundation in cell biology, genetics and developmental biology into practical understanding. |
|-----------|--|

<b>Course I</b>	:	<b>Core VI</b>	<b>Course Code</b>	<b>T2PZOC6</b>
<b>Course title</b>	:	<b>Lab Course in Cell Biology and Developmental Biology</b>		
<b>Credits</b>	:	<b>4</b>	<b>Hours/Week</b>	<b>6</b>

### Pre-requisite:

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

### Expected Course Outcome:

Upon completion of this lab course, students

<b>1.</b>	Acquire knowledge to differentiate the cells of various living organisms and become aware of physiological processes of cells e.g. cell divisions, various stages of fertilization and embryo development.	<b>K2</b>
<b>2.</b>	Understand and observe as well as correctly identify different cell types, cellular structures using different microscopic techniques.	<b>K3</b>
<b>3.</b>	Develop handling - skills through the wet-lab course.	<b>K6</b>
<b>4.</b>	Learn the method of culturing of <i>Drosophila</i> and identification of their wild and mutant strains	<b>K1 &amp; K2</b>
<b>5.</b>	Acquire skills to perform human karyotyping and chromosome mapping to identify abnormalities	<b>K1 &amp; K2</b>

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

### CELL AND MOLECULAR BIOLOGY

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

## DEVELOPMENTAL BIOLOGY

Gametogenesis - Observation of gametes from gonadal tissue sections

- i. Oogenesis:
  - ✓ Section through ovary of shrimp, fish, frog and mammals
- ii Spermatogenesis:
  - ✓ Section through testis of shrimp, fish, calotes and mammals

Fertilization

- iii Induced spawning in polychaete worm *Hydroids elegans*
- iv *In vitro* fertilization and development in a polychaete worm *Hydroids elegans*
- v Observation of egg developmental stages in *Emerita emeritus*

Embryogenesis

- vi Observation and whole mount preparation of the chick blastoderm - 18 hours of development
- vii Chick embryonic stage - 24 hours of development
- viii Chick embryonic stage - 48 hours of development
- ix Chick embryonic stage - 72 hours of development
- x Chick embryonic stage - 96 hours of development

Histological observation: Section through various developmental stages in chick embryo

Experimental Embryology

Regeneration in Frog Tadpoles

- xi Blastema formation
- xii Demonstration of regenerative process in tadpole

Metamorphosis

- xiii Demonstration of metamorphosis in Frog Tadpole using exogenous Iodine


Cryopreservation

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

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	S	L	L	M
CO2	S	S	S	S	S	M	M	M	M	M
CO3	S	S	M	S	S	L	S	M	L	M
CO4	M	M	L	M	L	M	M	S	M	L
CO5	S	S	M	L	S	M	L	S	S	S

\*S - Strong; M - Medium; L – Low

  
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## Ecology

### Course Objectives:

The main objectives of this course are:

1.	Knowing the ecology and climatic changes at world level and its impact on natural resources.
2.	Understanding the contributing factors for pollution in the environment and the ways in controlling and restoring to natural conditions

<b>Course I</b>	:	<b>Elective</b>	<b>Course Code</b>	<b>TPZOECC</b>
<b>Course title</b>	:	<b>Ecology</b>		
<b>Credits</b>	:	<b>3</b>	<b>Hours/Week</b>	<b>4</b>

### Pre-requisite:

Students should know about the fundamentals and studied the ecology of living organisms.

### Expected Course Outcome:

On the successful completion of the course, student will be able to

1.	Learn about the ecosystem, biotic communities and utilizing the energy processing	<b>K2</b>
2.	Study the various community and population and population control	<b>K2 &amp; K3</b>
3.	Understand the fundamentals of climatic conditions and its impact on environment	<b>K2 &amp; K6</b>
4.	Realizing the nature of pollution and the ways for its control/reduction	<b>K4 &amp; K5</b>
5.	Impact of environmental studies on solid waste management	<b>K2 &amp; K6</b>

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

## Units

<b>I</b>	The Environment: Physical environment; biotic environment; biotic and abiotic interactions. Habitat and niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.
<b>II</b>	Population ecology: Characteristics of a population; population growth curves; population regulation; life history strategies ( <i>r</i> and <i>K</i> selection); concept of metapopulation-demes and dispersal, interdemec extinctions, age structured populations -action taken to control population explosion.
<b>III</b>	Species interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis. Community ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones. Ecological succession: Types; mechanisms; changes involved in succession; concept of climax
<b>IV</b>	Ecosystem: Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).

	Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.
V	Applied ecology: Environmental pollution; global environmental change; biodiversity-status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches - Waste management. Conservation biology: Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

#### Reading list

1. Sharma, P.D. 2009. Ecology and Environment, Rastogi Publication, India, pp-616.
2. Calabrese, E.J. 1978. Pollutants and High-Risk Groups, John Wiley, pp-286.
3. Raven, P.H. and L.R. Berg, G.B. Johnson, 1993. Environment, Saunders College Publishing, pp-579.
4. Cunningham, W. P. and B. W. Saigo, 1999. Environmental Science, McGraw Hill Boston, 5th Edition.
5. Online courses.nptel.ac.in / noc 19 - g e 23/preview
6. Class central.com/course/swayam -ecology - and environment – 14021.

#### Recommended texts

1. Odum, E.P. 1893. Basic Ecology, Saunders & Co., Philadelphia, pp-383.
2. Barthwl, R.R. 2002. Environmental Impact Assessment, New Age International Publishers, New Delhi, India, pp-425.
3. United Nations Environment Programme (UNEP). 1995. Global Biodiversity Assessment, Cambridge University Press, pp-1140.

#### Mapping with Programme Outcomes\*

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

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RESEARCH METHODOLOGY			
<b>Course Objectives:</b>			
The main objectives of this course are:			
1.	Students understand the basic principle, methodology and applications of widely used instruments in biological sciences.		
Course	Elective IV	Course Code	TPZOECD
Course title	Research Methodology		
Credits	3	Hours/Week	4
<b>Pre-requisite:</b>			
Students should know the fundamentals of basic methods employed in experimental biology.			
<b>Expected Course Outcome:</b>			
On the successful completion of the course, student will be able to			
1.	Understand the implications of GLP		K1
2.	Learn the working principles of different instruments		K2
3.	Gain the knowledge on techniques of histology and histochemistry		K2 & K4
4.	Acquire knowledge on the basic principle and application of various modules of light and electron microscopy		K3 & K5

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

Units	
I	Good laboratory practice (GLP) - pH, Electrodes and pH meter - Colorimeter and Spectrophotometry.
II	Histology, Histochemistry, Bioinformatics and Electron microscopy.
III	Light Microscopy, Bright field, Phase contrast, DIC & Fluorescence microscopy, wide field and Confocal microscopy.
IV	Centrifuges, Chromatography, Electrophoresis, ELISA and blotting.
V	Principles and Applications of tracer techniques in biology, Animal cell culture techniques.
<b>Reading list</b>	
<ol style="list-style-type: none"> <li>1. Pearse, A.G. 1968. Histochemistry: Theoretical and Applied, Vol. I, Third Edition, J &amp; A Churchill Ltd, pp-758.</li> <li>2. Lillie, R.D. 1954. Histopathologic Technic and Practical Histochemistry, Second Edition, Blakiston, New York, pp-715.</li> <li>3. Hoppert, M. 2003. Microscopic Techniques in Biotechnology, Wiley-VCH GmbH, Weinheim, Germany, pp-330.</li> </ol>	
<b>Recommended texts</b>	
<ol style="list-style-type: none"> <li>1. Chandler, D.E. and Roberson R.W. 2009. Bioimaging: Current Concepts in Light and Electron Microscopy, Jones and Bartlet Publishers, Sudbury, MA, USA, pp440.</li> <li>2. Engelbert, B. 1960. Radioactive Isotopes in Biochemistry, Elsevier Applied Science, pp-376.</li> <li>3. Wolf, G. 1964. Isotopes in Biology, Academic Press, pp-173.</li> </ol>	

4. Srivastava, B. B. 2005. Fundamentals of Nuclear Physics, Rastogi Publications, pp-500.
5. Pantin, C. F. A. 1948. Microscopical Techniques, Cambridge University Press, London.

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	S	M	S	M	S	M	M
CO2	S	S	M	S	S	S	M	M	M	S
CO3	S	M	S	S	S	S	S	S	S	L
CO4	S	S	S	S	S	M	S	S	S	M
CO5	S	S	S	M	M	S	M	L	S	M

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



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THANJAVUR - 613 005.



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RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)  
THANJAVUR - 613 005.

## POULTRY FARMING

### Course Objectives:

The main objectives of this course are:

**1.** Students should know basic concepts in Vermiculture.

<b>Course I</b>	:	<b>SEC - I</b>	<b>Course Code</b>	<b>T2PZOS1</b>
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<b>Course title</b>	:	<b>Poultry Farming</b>
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<b>Credits</b>	:	<b>2</b>	<b>Hours/Week</b>	<b>4</b>
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### Pre-requisite:

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

### Expected Course Outcome:

Upon completion of this course, Students would have

I	To understand the various practices in Poultry farming. To know the needs for Poultry farming and the status of India in global market.	K2 & K3
II	To be able to apply the techniques and practices needed or Poultry farming.	K1, K2 & K3
III	To know the difficulties in Poultry farming and be able to propose plans against it.	K5 & K6

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

### Units

<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
<b>II</b>	Management of chicks - growers and layers - Management of Broilers. - Preparation of project report for banking and insurance.
<b>III</b>	Poultry feed management-Principles of feeding, Nutrient requirements for different stages of layers and broilers - Feed formulation and Methods of feeding.
<b>IV</b>	Poultry diseases-viral, bacterial, fungal and parasitic (two each); symptoms, control and management; Vaccination programme.
<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.

### Reading list

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

### Recommended texts

1. Ismail, S.A., 1997. Vermitechnology, The biology of earthworms, Orient Longman,

India.

2. <http://www.asci-india.com/BooksPDF/Small%20Poultry%20Farmer.pdf>

3. [https://nsdcindia.org/sites/default/files/MC\\_AGR-Q4306\\_Small-poultry-farmer-.pdf](https://nsdcindia.org/sites/default/files/MC_AGR-Q4306_Small-poultry-farmer-.pdf)

4. <http://ecoursesonline.iasri.res.in/course/view.php?id=335>


5. [https://swayam.gov.in/nd2\\_nou19\\_ag09/preview](https://swayam.gov.in/nd2_nou19_ag09/preview)

**Mapping with Programme Outcomes\***

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

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

  
**HEAD**  
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