

COURSES UNDER EMPLOYABILITY
B.Sc. ZOOLOGY
SEMESTER I

(For the students admitted during the academic year 2020 – 2021 and onwards)

Course: PART III – CORE I – NON CHORDATES-I	Course Code: 120Z01
Semester: I	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C: Contact hours, T:Tutorial)

Course Objectives:

- To provide knowledge about the taxonomic status of invertebrates.
- To acquire knowledge about biodiversity, habitat, adaptations and organization of Invertebrates
- To impart knowledge about general characteristics of invertebrates.
- To appreciate the basis of life processes in the non-chordates and recognize the economically important invertebrate fauna.
- To obtain knowledge about the pathogenicity, prevention and control of human parasites.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	discuss the taxonomy of protozoa, type study of Paramecium, protozoan diseases with pathogenicity, prevention and control.	R
CO2	describe the classification of Porifera, type study of <i>Scypha</i> and their economic importance.	R
CO3	recognise the taxonomy of Coelenterates, type study of Obelia and significance of corals and coral reefs.	U
CO4	discuss the classification of Platyhelminthes, type study of <i>Fasciola hepatica</i> and parasitic adaptations of helminth worms.	U
CO5	Describe the taxonomy of Aschelminthes, type study of <i>Ascaris lumbricoides</i> and common nematodes.	A

R-Remembrance U –Understanding A-Apply

Syllabus

General: Each unit should be dealt with salient features and general classification up to class Level with examples.

Unit I:	(11 hrs)
Phylum: Protozoa	
Type study : <i>Paramecium</i>	
General Topic: * <u>Protozoan diseases and their control.</u> (Plasmodium- life cycle in detail)	

Unit II	(10 hrs)
Phylum : Porifera	
Type study : <i>Sponge – Scypha</i>	

General Topic : *Economic importance of sponges.

Unit III (10 hrs)

Phylum : Coelenterata

Type study : *Obelia*

General Topic : Corals and Coral reefs.

Unit IV (11 hrs)

Phylum : Platyhelminthes

Type study : *Fasciola hepatica*

General topic : * Parasitic adaptations in Helminths

Unit V (10 hrs)

Phylum : Aschelminthes

Type study : *Ascaris lumbricoides*

General Topic : Common nematodes of man (*Wuchereria bancrofti*, *Enterobius vermicularis*, *Ancylostoma duodenale*)

*Starred and underlined topics are for self-study.

Books for study

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III, IV & V	A Textbook of Invertebrates	Dr. N. Arumugam	Saras Publications 2016
I,II, III, IV & V	Manual of Zoology Vol – I, Part I & II	Ekambaranatha Ayyar & T.N Ananthakrisnan	S.Viswanathan Pvt.Ltd., Chennai 1992

Books for Reference

Name of the Book	Authors	Publishers with Edition
Invertebrate Zoology	<u>P. S Verma , E.L.Jordon</u>	S.Chand & Co, New Delhi (2009)
Invertebrate Zoology	Barnes R.D	Holt Saunder International Edn. (1982)
Modern Text Book of Zoology	Kotpal R. Agarwal S.K and Khetarpal R.P	Rastogi Publications (1992)

E-Resources: (Web resources & E-books)

- <http://www.biologydiscussion.com/invertebrate-zoology/phylum-porifera/scypha-history-habitat-and-nutrition-with-diagram/28493>
- <http://www.biologydiscussion.com/invertebrate-zoology/phylum-coelenterata/obelia-habitat-structure-and-diagram/28685>
- <http://www.ucmp.berkeley.edu/aschelminthes/aschelminthes.html>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	H	M	L	H	L	R
CO2	M	M	L	H	L	R
CO3	H	M	L	H	L	U
CO4	H	M	L	H	L	U
CO5	H	M	L	H	L	A

Content Delivery Methods

1. Class room lecture
2. Using LCD
3. Museum specimens / Microscopic slides
4. Assignment
5. Field visit
6. Visit to Zoological park and Museum

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Objective Type Questions	Course Exit Survey

Internal Assessment components:

Components	CIA	Assignment	Objective Type Questions	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10X1=10 marks)
Section B	Either or Type - 5 Questions (5X4= 20 marks)
Section C	Either or Type - 5 Questions (5X9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I	CIA II	Assignment	Objective Type Questions
R	20%	20%	Overall Structure: 25% Content : 50% Presentation :25%	R- 30%
U	30%	30%		U- 40%
A	50%	50%		A- 30%

Blue Print for End Semester Examination

U N I T	Section A (10 x 1 = 10)										Section B (5 x 4 = 20)										Section C (5 x 9 = 45)										
	MCQ										11		12		13		14		15		16		17		18		19		20		
	1	2	3	4	5	6	7	8	9	10	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	
I	✓	✓								T	T							T	T												
II			✓	✓								T	T							T	T										
III					✓	✓								T	T							T	T								
IV							✓	✓								T	T							T	T						
V								✓	✓									T	T									T	T		

T: Theory

Course Designed by	Dr. K. Shobana	
Course Reviewed by	Dr. (Mrs.) S. Kalaichelvi	
Head of the Department	Dr. (Mrs.) S. Kalaichelvi (i/c)	

B.Sc. ZOOLOGY SEMESTER I

(For the students admitted during the academic year 2020 – 2021 and onwards)

Course: PART III–CORE II – NON CHORDATES-II	Course Code: 120Z02
Semester: I	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Course Objectives:

- To provide knowledge about the taxonomic status of invertebrates.
- To acquire knowledge about biodiversity, habitat, adaptations and organization of Invertebrates
- To impart knowledge about general characteristics of invertebrates.
- To appreciate the basis of life processes in the non-chordates.
- To gain knowledge about the economic importance of invertebrates.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	discuss the taxonomy of Annelida, type study of <i>Megascolex mauritii</i> , free swimming polychaetes and vermiculture.	R
CO2	describe the classification of <i>Periplaneta americana</i> , its type study, and peripatus.	R
CO3	recognise the taxonomy of mollusca, type study of <i>Pila globosa</i> and economic importance of mollusca	U

CO4	discuss the classification of Echinodermata and type study of <i>Asterias rubens</i>	U
CO5	describe the taxonomy of ctenophore, type study of <i>Pleuro branchia</i> and affinities of ctenophora.	A

R-Remembrance U –Understanding A-Apply

Syllabus

General: Each unit should be dealt with salient features and general classification up to class Level with examples

Unit I:	(10 hrs)
Phylum : Annelida	
Type study : <i>Megascolex mauritii</i>	
General Topics : 1. Adaptive Radiation in Polychaetes Free swimming: Nereis 2. Vermiculture.	

Unit II	11 hrs)
Phylum : Arthropoda	
Type study : <i>Periplanata americana</i>	
General Topic : * <u>Peripatus - The connecting Link</u>	

Unit III	(10 hrs)
Phylum : Mollusca	
Type study : <i>Pila globosa</i>	
General Topic : * <u>Economic importance of Mollusca</u>	

Unit IV	(10 hrs)
Phylum : Echinodermata	
Type study : <i>Asterias rubens</i> (Sea star)	
General Topic: Echinoderm Larvae and their evolutionary significance.	

Unit V	(11 hrs)
Minor Phylum : Ctenophora	
Type study : <i>Pleuro branchia</i>	
General Topic : * <u>Affinities of Ctenophora</u>	

*Starred and underlined topics are for self -study.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III, IV & V	A Textbook of Invertebrates	Dr. N.Arumugam	Saras Publications 2016
I,II, III, IV & V	Manual of Zoology Vol – I, Part I & II	Ekambaranathaayyar & T.N.Ananthkrishnan	S.Viswanathan Pvt.Ltd. Chennai 1992

Books for Reference:

Name of the Book	Authors	Publishers with Edition
Invertebrate Zoology	P. S Verma, E.L.Jordon	S.Chand & Co, New Delhi (2009)
Invertebrate Zoology IV Edn	Barnes R.D	Holt saunder International Edn. (1982)
Modern Text Book of Zoology	Kotpal R. Agarwal S.K and Khetarpal R.P	Rastogi Publications (1992)

E-Resources: (Web resources & E-books)

- <https://study.com/academy/lesson/phylum-annelida-characteristics-classes-examples.html>
- <https://en.wikipedia.org/wiki/Cockroach>
- <http://cec.nic.in/wpresources/module/Zoology/Paper-1/15/content/downloads/file1.pdf>
- <http://www.biologydiscussion.com/invertebrate-zoology/starfish/asterias-starfish-history-habitat-and-development/27860>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO 1	H	M	L	H	L	R
CO 2	M	M	L	H	L	R
CO 3	H	M	L	H	L	U
CO 4	H	M	L	H	L	U
CO 5	H	M	L	H	L	A

Content Delivery Methods

1. Class room lecture
2. Using LCD
3. Museum specimens
4. Assignment
5. Field visit
6. Visit to Zoological park and Museum

Course Evaluation Methods:

Direct Methods	Indirect Methods
Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Objective Type Questions	Course Exit Survey

Internal Assessment components:

Components	CIA	Assignment	Objective Type Questions	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10X1=10 marks)
Section B	Either or Type - 5 Questions (5X4= 20 marks)
Section C	Either or Type - 5 Questions (5X9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I	CIA II	Assignment	Objective Type Questions
R	20%	20%	Content : 50% Presentation :50%	50%
U	30%	30%		30%
A	50%	50%		20%

Blue Print for End Semester Examination

U N I T	Section A (10 x 1 = 10)										Section B (5 x 4 = 20)					Section C (5 x 9 = 45)												
	MCQ																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20								
										a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	
I	✓	✓								T	T					T	T											
II			✓	✓							T	T					T	T										
III					✓	✓						T	T					T	T									
IV							✓	✓					T	T						T	T							
V								✓	✓						T	T									T	T		

T: Theory

Course Designed by	Dr. K. Shobana	
Course Reviewed by	Dr. (Mrs.) S. Kalaichelvi	
Head of the Department	Dr. (Mrs.) S. Kalaichelvi (i/c)	

**B.Sc. ZOOLOGY
SEMESTER II**

(For the students admitted during the academic year 2020 – 2021 and onwards)

Course: PART III – Core III – CHORDATES	Course Code: 220Z03
Semester: II	No. of Credits: 4
No. of hours : 120	C:T 104:16
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Course Objectives:

- To gain knowledge about the habitat, adaptations and organization of vertebrates.
- To provide knowledge about the general characteristics and classification of chordates.
- To acquire knowledge about morphology, physiology and anatomy of chordates.
- To analyse the basics of life processes and the economically important vertebrate fauna.
- To make them understand the evolutionary relationships between the other related Phyla.

- To study the biodiversity of chordates.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	discuss the taxonomy of Prochordata and Pisces, type study of <i>Balanoglossus</i> and shark, and migration in fishes.	R
CO2	describe the classification of Amphibia, type study of frog, neoteny and parental care in Amphibia.	U
CO3	recognise the taxonomy of Reptiles, type study of Calotes, Sphenodon and Indian poisonous snakes.	R
CO4	discuss the classification of Aves, type study of Pigeon and <i>Ratitae</i>	A
CO5	describe the taxonomy of mammals, type study of rabbit, monotremes and aquatic mammals.	U

R-Remembrance U –Understanding A-Apply

Syllabus

General: Each unit should be dealt with salient features and general classification up to class Level with examples

Unit I: Protochordata & Pisces	(21 hrs)
Type Study : 1. <i>Balanoglossus</i> (Including affinities) 2. Shark (Excluding skeleton)	
General Topic : Migration in Fishes	
Unit II : Amphibia	(21 hrs)
Type Study : Frog (Excluding skeleton)	
General Topics : 1. Neoteny 2. Parental Care in Amphibia	
Unit III : Reptilia	(21 hrs)
Type Study : <i>Calotes</i> (Excluding skeleton)	
General Topics : 1. Sphenodon (Brief account of structure and affinities) 2. * <u>South Indian Poisonous Snakes</u>	
Unit IV : Aves	(20 hrs)
Type Study : Pigeon (Skeleton - Appendicular Skeleton only).	
General Topics : 1. <i>Ratitae</i> 2. Migration in Birds	
Unit V : Mammals	(21 hrs)

Type Study	: Rabbit (Excluding Skeleton)
General Topics	: 1. General Account of Monotremes 2. Aquatic Mammals

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III, IV & V	A text book of Chordates	Thangamani, A., Prasana kumar, S.Narayanan, L.M. and Arumugam, N	Saras Publications 2016

Books for Reference:

Name of the Book	Authors	Publishers with Edition
A Manual of Zoology Vol II, Part I & II	Ekambaranatha Ayyar & T.N Ananthakrisnan	S.Viswanathan Pvt.Ltd. Chennai (1992)
Chordates Zoology and Animal Physiology	E.L.Jordan. & P.S.Verma	S.Chand & Co, New Delhi (2000)

E-Resources: (Web resources & E-books)

- http://www.shsu.edu/~bio_mlt/Aves.html
- <https://www.britannica.com/animal/mammal>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO 1	H	H	L	M	M	R
CO 2	H	H	L	M	M	U
CO 3	H	H	L	M	M	R
CO 4	H	H	L	M	M	A
CO 5	H	H	L	M	M	U

Content Delivery Methods

1. Class room lecture
2. Using LCD
3. Laboratory class and demonstration
4. Museum specimens
5. Assignment
6. Visit to Zoological park and Museum

Course Evaluation Methods:

Direct Methods	Indirect Methods
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Continuous Internal Assessment Test I Continuous Internal Assessment Test II Assignment Objective Type Questions	Course Exit Survey
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Internal Assessment components:

Components	CIA	Assignment	Objective Type Questions	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10X1=10 marks)
Section B	Either or Type - 5 Questions (5X4= 20 marks)
Section C	Either or Type - 5 Questions (5X9= 45 marks)

Questions for CIA will be designed based on Weightage % given

Bloom's Category	CIA I	CIA II	Assignment	Objective Type Questions
R	20%	20%	Content : 50% Presentation :50%	50%
U	30%	30%		30%
A	50%	50%		20%

Blue Print for End Semester Examination

U N I T	Section A (10 x 1 = 10)										Section B (5 x 4 = 20)					Section C (5 x 9 = 45)											
	MCQ										11	12	13	14	15	16	17	18	19	20							
	1	2	3	4	5	6	7	8	9	10	a	b	a	b	a	b	a	B	a	b	a	b	a	b	a	b	
I	✓	✓									T	T							T	T							
II			✓	✓								T	T							T	T						
III					✓	✓							T	T							T	T					
IV							✓	✓							T	T							T	T			
V									✓	✓							T	T							T	T	

T: Theory

Course Designed by	Dr. K. Shobana	
Course Reviewed by	Dr. (Mrs.) S. Kalaichelvi	
Head of the Department	Dr. (Mrs.) S. Kalaichelvi (i/c)	

**B.Sc. ZOOLOGY
SEMESTER III**

(For the students admitted during the academic year 2020-2021 only)

Course: PART III–CORE IV – CELL BIOLOGY AND BIOCHEMISTRY	Course Code: 320Z04
Semester: III	No. of Credits: 4
No. of hours : 75	C:T 65:10
CIA Max. Marks: 25	ESE Max. Marks: 75

(C:Contact hours, T:Tutorial)

Course Objectives:

- To illustrate the basic structure and functions of cell.
- To gain knowledge about the instruments useful for biological studies.
- To study the various cytological techniques to understand the ultra-structure of the cell types.
- To acquire knowledge about symptoms, causes, effects and treatment of cancer.
- To gain knowledge on basic principles of biochemistry.
- To understand the importance of healthy life and significance of balanced diet.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	describe the cell structure and their types and demonstrate different microscopes and cytological techniques and structure of plasma membrane and protoplasm.	U
CO2	relate the structure of ER, Golgi complex, mitochondria, lysosome and ribosomes with their functions	U
CO3	explain structure and functions of centrosome, nucleus, chromosomes, structure of DNA and RNAs.	U
CO4	describe the structure of chromatin and define cell division, cancer cells, stem cells and cell aging.	U
CO5	explain the structure and biological significance of carbohydrates, lipids, proteins, DNA and vitamins	U

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I:	(13 hrs)
<ol style="list-style-type: none"> 1. Introduction to cell biology, cell theory, Cell Structure- size, shape, and characteristics of prokaryotic and eukaryotic cells. 2. Microscopy: Compound, Electron, Fluorescent microscope, Phase contrast and Oil immersion microscope 3. Cytological Techniques- microtomy 4. *Plasma membrane: ultrastructure and functions 5. Protoplasm: physical and biological properties. 	

I,II, III & IV	Introduction to Cytology	Veebala Rastogi	Kedarnath Ramnath publications, VIII Edition (1993).
V	Biochemistry	Dulsy Fatima et al.,	Saras Publication, IV edition (2014)

Books for Reference:

Name of the Book	Authors	Publishers with Edition
Molecular Biology	De. Robertis	W.B. Saunder Company, VI Edition (1996).
Cell Biology	Power	C.B.Himalaya publication House, III Edition (1987).
Biochemistry	L.Veerakumari	M.J.P.Publishers, Chennai (2004)

E-Resources: (Web resources & E-books)

- <https://nptel.ac.in/courses/102103015/module3/lec2/2.html>
- <https://nptel.ac.in/courses/102103012/1>
- <https://nptel.ac.in/courses/102103012/18>
- <https://nptel.ac.in/courses/102103012/module2/lec1/2.html>
- <https://nptel.ac.in/courses/102103041/pdf/mod4.pdf>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level levels
CO1	H	H	L	H	H	U
CO2	H	H	L	H	H	U
CO3	H	H	L	H	H	U
CO4	H	H	L	H	H	U
CO5	H	H	L	M	H	U

Internal Assessment components:

Components	CIA	Assignment	Objective Type Questions	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10X1=10 marks)
Section B	Either or Type - 5 Questions (5X4= 20 marks)
Section C	Either or Type - 5 Questions (5X9= 45 marks)

**B.Sc. ZOOLOGY
SEMESTER IV**

(For the students admitted during the academic year 2020-2021 only)

Course: PART III - CORE V – ENVIRONMENTAL BIOLOGY AND EVOLUTION	Course Code: 420Z05
Semester: IV	No. of Credits: 4
No. of hours : 75	C:T 65:10
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Course Objectives:

- To analyse the basic concepts of animal relationship.
- To study the importance of biotic and abiotic factors and biogeochemical cycles.
- To gain knowledge about biochemical origin of life,

- To appreciate the biochemical origin of life and principles of evolution

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Describe the characteristics of fresh water ecosystem, marine water ecosystem, soil, light and temperature.	U
CO2	Describe the characteristics of commensalisms, mutualism, parasitism, predation, competition, various chemical cycles and wild life management.	U
CO3	Discuss the various laws available to protect the wild life. Analyze and discuss the various types of pollution, Renewable and Non - Renewable resources.	U
CO4	Describe the physiological, biochemical and structural evidences of evolution, fossils and dating of fossils and theories of evolution.	U
CO5	Expound the types and sources of variation, speciation and adaptive radiation in mammals.	U

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I:	(13 hrs)
Habitat Ecology	
<ol style="list-style-type: none"> Water: Fresh water ecosystem – Marine ecosystem Soil: Soil texture, soil profile, pedogenesis, soil as a habitat for organisms, adaptations of soil animals – soil erosion – types and effects. Light: *<u>Spectral composition, biological effects of light.</u> Temperature: Thermal stratification, classification of organisms, biological effects and adaptations. 	
Unit II	(13 hrs)
<ol style="list-style-type: none"> Animal Relationships <ol style="list-style-type: none"> Neutralism Symbiosis: commensalisms and mutualism Antagonism: parasitism, predation and competition. Bio-Geochemical Cycles <ol style="list-style-type: none"> Gaseous Cycles: carbon cycle, nitrogen cycle and oxygen cycle, *<u>Sedimentary cycle, phosphorous and sulphur cycle.</u> 	
Unit III	(13 hrs)
<ol style="list-style-type: none"> Natural resources <ol style="list-style-type: none"> Wild life management – aims of wild life conservation – necessity for conservation - methods of conservation – organizations involved in wild life conservation Sanctuaries and national Parks, Project tiger and Project Elephant <p>Extra Terrestrial Environment</p> <ol style="list-style-type: none"> Exobiology – definition – methods for testing extra-terrestrial life – An exobiological survey of the solar system – SETI programme. 	

2. Space travel and man – Environmental problems of space travel – physiological changes during space travel.

Unit IV (13 hrs)

1. *Biochemical origin of life – Urey – Miller’s experiment.
2. Evidences for evolution: Evidences from Morphology and comparative anatomy – Homologous structures - forelimb, heart and mouth parts, analogous structures. Vestigial Organs – vermiform appendix and coccyx.
3. Physiological and biochemical evidences – protoplasm, chromosomes, DNA, enzymes, hormones, visual pigments, excretory products and Precipitin test.
4. Fossils- Dating of fossils
Theories – 1) Lamarckism and Neo-Lamarckism 2) Darwinism and Neo- Darwinism.

Unit V (13 hrs)

1. Variation – definition, types, sources
2. Species concept- salient features, sibling species, sub species and demes
3. Speciation – Types, factors influencing speciation
4. *Adaptive radiation in mammals.

***Starred and underlined topics are for self-study.**

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,II & V	Concepts of Ecology	N. Arumugam and others	Ramnath Publications (1990)
III & VI	Organic Evolution	N. Arumugam	Saras Publications (2010)

Books for Reference:

Unit	Name of the Book	Authors	Publishers with Edition
I,II & V	Principles of Ecology	P.S. Verma & V.K. Agarwal	S. Chand & Company Ltd, Fourth Edition (2000)
III & VI	Concepts of Evolution	P.S. Verma & V.K. Agarwal	S. Chand and Company limited, New Delhi (2000)

E-Resources: (Web resources & E-books)

- <https://nptel.ac.in/courses/122103039/39>
- <https://nptel.ac.in/courses/122103039/38>
- https://nptel.ac.in/courses/105106114/pdfs/Unit1/1_4k.pdf
- <https://nptel.ac.in/courses/104103020/module2/lec1/3.html>
- <https://nptel.ac.in/courses/102104068/25>

Mapping of Course outcome with POS

CO	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom’s Taxonomy level
CO1	H	M	M	H	M	U
CO2	H	M	M	H	M	U
CO3	H	M	M	M	M	U
CO4	M	M	M	M	M	U
CO5	M	M	M	M	L	U

Internal Assessment components:

Components	CIA	Assignment	Online Test	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10X1=10 marks)
Section B	Either or Type - 5 Questions (5X4= 20 marks)
Section C	Either or Type - 5 Questions (5X9= 45 marks)

**B.Sc. Zoology
SEMESTER V**

(For the students admitted during the academic year 2020-2021 only)

Course: PART III - CORE VI - PHYSIOLOGY	Course Code: 520Z06
Semester: V	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Course Objectives:

- To instil knowledge about the chemical process associated with living cell.
- To comprehend the physiological activity of an organ system in human.
- To impart knowledge in osmo-regulation and excretion in man.
- To develop knowledge about receptors, effectors, and bioluminescence.
- To acquire knowledge in endocrinology.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	explain the physiology of digestion in man.	U
CO2	discuss respiration and circulation in man.	U
CO3	describe the process of excretion in man and also about dialysis.	U
CO4	explain muscle and nerve physiology in man.	U
CO5	discuss receptors and endocrine glands of man.	U

R-Remembrance U –Understanding A-Apply**Syllabus:**

Unit I:	(11hrs)
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1. *Digestion – Structure of digestive system of man in detail.
2. Chemical process of digestion, absorption and assimilation of carbohydrates, proteins and lipids.
3. Metabolism - Introduction and definition – metabolism of carbohydrate, glycogenesis – glycogenolysis - glycolysis.
4. Metabolism of Protein – Deamination – transamination – decarboxylation – transmethylation – ornithine cycle.
5. Metabolism of Lipid: - oxidation of fatty acids and oxidation of glycerol.

Unit II: Respiration and Circulation (10 hrs)

1. *Types of Respiratory pigments.
2. Transport of O₂ and CO₂ – Bohr Effect – O₂ Dissociation curve - Chloride shift.
3. Structure, composition and functions of blood, mechanism of blood coagulation
4. Origin and conduction of heart beat in a myogenic heart – cardiac cycle, heart sounds
5. Regulation of heartbeat – Electrocardiogram (ECG).

Unit III: Excretion (10 hrs)

1. Structure of kidney and nephron.
2. Mechanism of urine formation - Ultrafiltration, reabsorption and secretion.
3. Hair-pin Counter Current Theory
4. Dialysis, Dialyser

Unit IV (10 hrs)

Muscle Physiology

1. Detailed structure of a voluntary – striped muscle fibre.
2. Properties of skeletal muscles.
3. Physicochemical changes during muscular contraction – sliding filament theory.

Nerve physiology

1. *Structure and types of neurons and synapses.
2. Definition of nerve impulse, conduction of nerve impulse through a nerve fibre and synapse.

Unit V: (11 hrs)

Receptors

1. *Receptors – Chemoreceptors, mechanoreceptors, olfactoreceptors, gustatoreceptors phonoreceptors and photoreceptors.

Endocrinology

1. Structure of Pituitary gland.
2. Effects of hypo and hyper secretions of thyroid – parathyroid – islets of Langerhans - adrenal.
3. Human reproductive hormones

***Starred and underlined topics are for self study.**

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III, IV and V	Textbook of Animal physiology	N.Arumugam	Saras Publication, Revised Edition (2010)

Books for Reference:

Name of the Book	Authors	Publishers with Edition
Essentials of Animal physiology	S.C.Rastogi	New Age International (P) Ltd, Publishers, III Edition (2001)
Animal physiology	A.Mariakuttan and N.Arumugam	Saras Publication, Revised Edition (2014).

E-Resources: (Web resources & E-books)

- <https://nptel.ac.in/courses/126104004/>
- <https://opentextbc.ca/biology/chapter/11-3-circulatory-and-respiratory-systems/>
- <https://nptel.ac.in/courses/122103039/17>
- <https://www.researchgate.net/publication/262990206> the human nervous system third edition
- <https://nptel.ac.in/courses/109104029/25>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Cognitive levels
CO1	H	H	L	H	-	U
CO2	H	H	L	H	-	U
CO3	H	H	L	H	-	U
CO4	H	H	L	H	-	U
CO5	H	H	L	H	-	U

Internal Assessment components:

Components	CIA	Assignment	Online Test	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10X1=10 marks)
Section B	Either or Type - 5 Questions (5X4= 20 marks)
Section C	Either or Type - 5 Questions (5X9= 45 marks)

**B.Sc. ZOOLOGY
SEMESTER V**

(For the students admitted during the academic year 2020-2021 only)

Course: PART III - CORE VII - BIOTECHNOLOGY	Course Code: 520Z07
Semester: V	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Course Objectives:

- To impart knowledge in scope and significance of biotechnology.
- To provide knowledge in genetic engineering, gene cloning, genomic library and gene therapy.
- To gain knowledge in DNA finger printing, biosensor and biochip.
- To analyze the importance of monoclonal antibodies.
- To instil knowledge in single cell protein, tissue culture and nanobiotechnology.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	describe the types and importance of IPR, concepts and applications of genetic engineering and organisms, enzymes and vectors important in Biotechnology.	U
CO2	explain the methods and applications of gene cloning, genomic Library, gene therapy and DNA finger printing, importance of biosensors, bio chips, genomics and proteomics.	U
CO3	describe the production and application of monoclonal antibodies, fermentation, SCP, methods and application of blotting techniques, Principles and techniques of plant and animal tissue culture and cell line culture.	U
CO4	explain the methods and applications of protoplast technology, cryopreservation, Human genome project, transgenic organisms and Risks of releasing genetically engineered organisms	U
CO5	explain the importance of drug delivery systems, applications of protein microarray, quantum dot technology, biosynthesis of nanoparticles, methods and applications of drug designing.	U

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I	(10 Hrs)
<ol style="list-style-type: none"> 1. <u>*Definition – Scope and importance of biotechnology.</u> 2. Biotechnology in India – GATT, IPR, TRIPS. 3. Basics of genetic engineering and Organisms important in Biotechnology – Bacteria, Virus. 4. Enzymes useful for Genetic engineering – (Reverse transcriptase, DNA ligase, Restriction Endonuclease) 5. Vectors – plasmids, shuttle vectors and cosmids. 	
Unit II	(10 Hrs)
<ol style="list-style-type: none"> 1. Gene cloning – gene cloning methods – Applications 2. Genomic Library and gene therapy 3. <u>*Biosensors & Bio chips.</u> 4. DNA finger printing 5. Genomics and Proteomics 	
Unit III	(10 Hrs)
<ol style="list-style-type: none"> 1. Monoclonal antibodies – Production and Applications. 2. Blotting techniques- Southern and Western. 3. Structure of fermenter tank and Alcohol fermentation. 4. <u>*Production of single cell protein (SCP) – Spirulina, Chlorella.</u> 5. Principles and techniques of plant and animal tissue culture and cell line culture. 	
Unit IV	(11 Hrs)

1. Protoplast technology – Isolation of protoplast, viability test for protoplast, plant regeneration from protoplasts, applications, Protoplast fusion methods and uses.
2. Cryobiology-Methods and applications of cryopreservation.
3. Transgenic technology – transgenic mice, fish, sheep, pig and *Bacillus thuringiensis*.
4. Risks of releasing genetically engineered organisms.

Unit V: Nano biotechnology (11 Hrs)

1. Nano biotechnology - Relationship between biology and nanobiology – drug delivery systems – technologies –Prostheses and Implants – diagnosis and screening – DNA and Protein microarray – Australian synchrotron – Gene chip.
2. Quantum dot technology in cancer treatment.
3. Biosynthesis of nanoparticles in bacteria, fungi and yeast.
4. Drug designing.

***Starred and underlined topics are for self study.**

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III & IV	Biotechnology	V. Kumaresan	Saras Publications, Revised Edition (2010)
V	Nanobiotechnology	Subbiah Balaji	MJP publishers (2010).

Books for Reference:

Name of the Book	Authors	Publishers with Edition
A textbook of Biotechnology	U.Satyanarayana	Uppla Author Publisher Interlinks (2005)
A textbook of Biotechnology	R.C. Dubey	S. Chand & Co, Revised Edition (2006)

E-Resources: (Web resources & E-books)

- <https://nptel.ac.in/courses/102103045/download/mod1.pdf>
- <https://nptel.ac.in/courses/109103024/pdf/module8/SM%20Lec%2041.pdf>
- <https://nptel.ac.in/courses/102103013/module8/lec2/5.html>
- <https://nptel.ac.in/courses/102103016/module3/lec28/4.html>
- <https://nptel.ac.in/courses/102103017/>
- <https://nptel.ac.in/courses/118102003/>

Mapping of Course outcome with POS

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	H	M	M	H	H	U
CO2	H	M	M	H	H	U
CO3	H	M	M	M	H	U
CO4	H	M	M	H	M	U
CO5	H	M	M	H	M	U

Internal Assessment components:

Components	CIA	Assignment	Objective type questions	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10X1=10 marks)
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Section B	Either or Type - 5 Questions (5X4= 20 marks)
Section C	Either or Type - 5 Questions (5X9= 45 marks)

**B.Sc. ZOOLOGY
SEMESTER VI**

(For the students admitted during the academic year 2020-2021 only)

Course: PART III - CORE XI – DEVELOPMENTAL BIOLOGY	Course Code: 620Z11
Semester: VI	No. of Credits: 4
No. of hours : 75	C:T 65:10
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Course Objectives:

- To understand basic concepts of developmental biology
- To identify and define the advances in developmental biology.
- To acquire knowledge in organogenesis, growth, regeneration and aging.
- To instil knowledge in the experimental aspects of embryology.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	understand the historical review of developmental biology theories and gametogenesis.	U
CO2	describe the theories of fertilization, cleavage, features, planes and patterns in amphioxus, frog and chick.	U
CO3	explain morula, blastula, gastrulation, describe fate map in frog and chick and organogenesis development of brain and heart in frog.	U
CO4	describe the organiser concept, chick embryo development stage (24hrs, 48hrs and 72hrs) Extra embryonic membrane and define in mammals.	U
CO5	describe sexual cycles, infertility, test tube, parthenogenesis, report on teratogenesis and regeneration.	U

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I	(13 Hrs)
1. Historical review of developmental biology - Theories (a) Aristotle's theory (b) Preformation theory (c) Epigenesis theory (d) Gradient theory (e) Organiser theory 2. Gametogenesis - (a) Spermatogenesis –Structure of a typical sperm, significance. (b) Oogenesis, *egg types, egg membranes.	
Unit II	(13 Hrs)

1. Fertilization–physicochemical and cytological factors, physiological changes – significance.
2. Theories of fertilization: Theory of Boveri, Theory of Loeb, Theory of Bataillon, Fertilizin - Antifertilizin theory, Theory of Tyler.
3. *Parthenogenesis.
4. Cleavage, features, planes and patterns. Cleavage in Amphioxus, frog and chick

Unit III**(13 Hrs)**

1. Morula and types of blastula.
2. Gastrulation, features, gastrulation in frog and chick.
3. *Fate map, construction of fate map, fate map in frog and chick.
4. Organogenesis in frog - development of brain and heart.
5. Gradient theory – types, experimental evidences, factors affecting gradients and mechanism of gradients.

Unit IV**(13 Hrs)**

1. Chick embryo – developmental stages: (a) 24 hours (b) 48 hours (c) 72 hours
2. Extra embryonic membranes in Chick.
3. Placentation in Mammals: Definition – formation – classification with examples and functions.
4. *Amniocentesis.

Unit V**(13 Hrs)**

1. Sexual Cycles – Oestrous cycle, puberty, menstrual cycle, pregnancy and parturition.
2. Infertility.
3. *Test tube baby.
4. Teratogenesis – Genetic teratogenesis – environmental teratogenesis, developmental mechanism of teratogenesis.
5. Regeneration – Laws, survey of capacity for regeneration in animals – types – events - factors influencing regeneration - physiological changes - Wolffian regeneration.

***Starred and underlined topics are for self study**

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III, IV & V	Chordate Embryology	P.S. Verma and V. K. Agarwal	S.Chand & Co, New Delhi, 1996

Books for Reference:

Name of the Book	Authors	Publishers with Edition
Textbook of Embryology	N. Arumugam	Saras Publication revised edition 2010.
An Introduction to Embryology	B.I.Balinsky	W.B.Saunders company, III Edition, 1970

E-Resources: (Web resources & E-books)

- <https://nptel.ac.in/courses/122103039/module3/lec20/2.html>
- <http://www.biologydiscussion.com/embryology/cleavage-meaning-planes-and-types-embryology/59904>
- https://www.tcd.ie/Biology_Teaching_Centre/assets/pdf/by1101/pmby1101/pmby1101-lectures4and5-2013.pdf

- <https://www.ncbi.nlm.nih.gov/pubmed/27155775>

Mapping of Course outcome with POS

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	H	H	H	H	M	U
CO2	H	H	H	H	H	U
CO3	H	H	H	H	H	U
CO4	H	H	H	H	H	U
CO5	H	H	H	M	H	U

Internal Assessment components:

Components	CIA	Assignment	Objective Type Questions	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10X1=10 marks)
Section B	Either or Type - 5 Questions (5X4= 20 marks)
Section C	Either or Type - 5 Questions (5X9= 45 marks)

B.Sc. ZOOLOGY SEMESTER V

(For the students admitted during the academic year 2020-2021 only)

Course: PART III - Elective I – CLINICAL LABORATORY TECHNIQUES	Course Code: 520ZE1
Semester: V	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Course Objectives:

- To impart basic principles and applications of clinical laboratory techniques.
- To expertise clinical haematology, serology and blood bank.
- To analyse urine, faecal and sputum samples.
- To acquire knowledge in infections and diseases.
- To provide knowledge about first –aid

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	understand the collection and disposal of specimens with reporting pattern and safety measures in clinical lab. First aid for lab accident and test for typhoid and tuberculosis.	U
CO2	analyze the collection of blood, RBC, WBC count, erythrocyte sedimentation rate, Hb estimation, bleeding time, clotting time and types of anticoagulants.	U
CO3	understand the VDRL test, Blood – Urea – Nitrogen estimation of Serum cholesterol ,Blood sugar and Testing the blood donor .	U

CO4	discuss the physico- chemical properties and microscopical examination of urine and stool, identification of intestinal parasite and diagnosis of chronic disease leprosy.	U
CO5	analyze the Fractional test meal, CSF examination, Semen analysis, Pregnancy test investigation of throat swab for Diphtheria and Corona virus infection.	U

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I: Collection and Sample Analysis	(10 Hrs)
<ol style="list-style-type: none"> 1. Collection and disposal of specimen- blood, sputum, urine and stool. 2. Reporting pattern of sample analysis. 3. <u>*Safety measures in clinical lab.</u> 4. First aid for superficial wounds, burns and electrical shocks. 5. WIDAL test 6. Mountoux test 	
Unit II: Clinical Haematology	(11 Hrs)
<ol style="list-style-type: none"> 1. Collection of blood – capillary blood collection and venous blood collection. 2. Anti – coagulants preparation - double oxalate mixture, EDTA, heparin and sodium citrate. 3. Blood cell count: RBC count and WBC count. 4. Erythrocyte sedimentation Rate (ESR): Westergren’s method and wintrobe’s method. 5. Haemoglobin Estimation (Hb): Acid haematin method 6. <u>*Bleeding Time (BT) - Blotting paper method. Clotting time (CT) -Slide Method and capillary tube method.</u> 	
Unit III: Serology and Blood bank	(10 Hrs)
<ol style="list-style-type: none"> 1. VDRL test – Kahn’s test and flocculation test. 2. Blood – Urea – Nitrogen (BUN) estimation: Hensch and Aldrich’s method 3. Serum cholesterol estimation – Anderson and Key’s method. 4. Blood sugar estimation – Glucose Tolerance Test (GTT) 5. Quantitative analysis of sugar by Folin-wu tube method. 6. Testing the blood donor - blood transfusion – donor screening 7. Compatibility test – Coombs test. 	
Unit IV:	(11 Hrs)
Urine Analysis: (only 2 test for each)	
<ol style="list-style-type: none"> 1. Physical properties of urine: colour, specific gravity, pH, 2. Microscopic examination of pus cells and casts in urine 3. Chemical properties of urine: Albumin, Sugar, Blood, Bile salt, Bile pigment: Bilirubin and Urobilinogen (qualitative analysis). 	
Faecal Analysis:	
<ol style="list-style-type: none"> 4. Physical and Microscopic Examination of stool 5. Identification of intestinal parasite – Direct smear examination –Anal Swab method. 6. Diagnosis of chronic disease: <i>Mycobacterium leprae</i> causing leprosy. 	

Unit V: Analysis of Gastric Juice and Body Fluids	(10 Hrs)
1. GJ - aspiration by Ryles tube, Fractional test meal – Free acid and Total acid (FA & TA) 2. CSF examination: Composition, physical examination, chemical examination, total count, differential count and Pandy's test. 3. Semen analysis: Total count, abnormality, movement, pH and viscosity 4. Pregnancy test – Gravindex test and card method. 5. Investigation of throat swab – Diphtheria and Corona infection.	

***Starred and underlined topics are for self study.**

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III, IV & V	Clinical Lab Techniques	K.M. Samuel	M.K.G. Iyer & sons edition 1990
	Clinical Pathology and Bacteriology	Dr. K.N. Sachdev	Jaypee Brothers Medical Publishers, 1990

Books for Reference:

Name of the Book	Authors	Publishers with Edition
Medical Laboratory Techniques Volume I, II & III	Kanaiah Mukerjii	Tata MC Graw Hill publishing Company, 4 th edition, 2006
Medical Laboratory Technology	Dr. Ramnik Sood M.D	Jaypee Brothers, Medical publishers, 2003.

E-Resources: (Web resources & E-books)

- <https://www.mayoclinic.org/first-aid/first-aid-electrical-shock/basics/art-20056695>
- <https://www.ncbi.nlm.nih.gov/books/NBK248/>
- <https://pdfs.semanticscholar.org/5468/732899e5a975053e354920ab98a1fd490342.pdf>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	H	H	M	M	M	U
CO2	H	H	M	M	M	U
CO3	H	H	M	M	M	U
CO4	H	H	M	M	M	U
CO5	H	H	M	M	M	U

Internal Assessment components:

Components	CIA	Assignment	Internship training / Report	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10X1=10 marks)
Section B	Either or Type - 5 Questions (5X4= 20 marks)
Section C	Either or Type - 5 Questions (5X9= 45 marks)

**B.Sc., ZOOLOGY
SEMESTER – V**

(For the students admitted during the academic year 2020-2021 only)

Course: PART III - Elective I – BIOINSTRUMENTATION	Course Code: 520ZE2
Semester: V	No. of Credits: 4
No. of hours : 60	C:T 52:8
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Course Objectives:

1. To enable the student to acquire knowledge in biological instruments.
2. To learn the basic operation of biological instruments.
3. To enrich knowledge in biotechnology

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	state the principle and functioning of Laminar airflow, Autoclave, Haemocytometer and employ it in research.	U
CO2	Study the operative method of the pH meter, colorimeter and Centrifuge.	U
CO3	Study the operative method of the working of spectrophotometer and their types, flow cytometry for measurement of cells.	U
CO4	Study the operative method , principle, technique, application of paper chromatography, RIA, ELISA	U
CO5	Study the operative method of the principle, technique, application, advantages and disadvantages of SDS,PAGE and PCR	U

R-Remembrance U –Understanding A-Apply

Syllabus:

UNIT I:	(12Hrs)
<ol style="list-style-type: none"> 1. Laminar airflow- principle and function. 2. *Autoclave- The instrumentation- principle and function of some common autoclaves. 3. Haemocytometer- practical application for counting cells, counting of RBC's and WBC's. 	

UNIT II:	(11 Hrs)
<ol style="list-style-type: none"> 1. Principle and working of pH meter 2. The colorimeter – Beer- Lamberts law, principle and working of calorimeter, monochromatore: filters, diffraction grating, Prisms: Applications,merits and demerits of colorimeter. 3. * Centrifuge:Principle types and applications types. 	

UNIT III:	(11 Hrs)
<ol style="list-style-type: none"> 1.Principle and working of spectrophotometer UV and visible, applications, merits and demerits of spectrophotometer. 2.*Floweytometry-instrumentation and applications. 	

UNIT IV:	(10 Hrs)
1. Principle, technique, application, advantages and disadvantages of paper chromatography, thin layer chromatography. 2. Immunological techniques- RIA and ELISA. 3. Blotting Techniques	

UNIT V:	(10 Hrs)
1. Principle, technique, application, advantages and disadvantages of SDS, PAGE Electrophoresis (PAGE agarose gel electrophoresis) 2. PCR- History, primers, procedure and working principle and applications of PCR.	

Starred and underlined topics are for self study.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III, IV & V	Biological instrumentation and Methodology	P.K.Bajpai	S.Chand & company Ltd. 2006.
	Biomedical instrumentation	Dr.M.Arumugam	Anuradha publications, 2008.

Books for Reference:

Name of the Book	Authors	Publishers with Edition
Medical Laboratory Techniques Volume I, II & III	Kanaiah Mukerjii	Tata MC Graw Hill publishing Company, 4 th edition, 2006
Medical Laboratory Technology	Dr.Ramnik Sood M.D	Jaypee Brothers, Medical publishers, 2003.

E-Resources: (Web resources & E-books)

- <https://www.mayoclinic.org/first-aid/first-aid-electrical-shock/basics/art-20056695>
- <https://www.ncbi.nlm.nih.gov/books/NBK248/>
- <https://pdfs.semanticscholar.org/5468/732899e5a975053e354920ab98a1fd490342.pdf>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	H	H	M	M	M	U
CO2	H	H	M	M	M	U
CO3	H	H	M	M	M	U
CO4	H	H	M	M	M	U
CO5	H	H	M	M	M	U

Internal Assessment components:

Components	CIA	Assignment	Internship training / Report	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10X1=10 marks)
Section B	Either or Type - 5 Questions (5X4= 20 marks)
Section C	Either or Type - 5 Questions (5X9= 45 marks)

**B.Sc. ZOOLOGY
SEMESTER II**

(For the students admitted during the academic year 2020 – 2021 and onwards)

As per UGC guidelines No. F.14-63014(CPP-II) dated 1st August 2014
Ensuring a close observance of high ethical considerations, the use of animals for dissection and experimentation is not permitted. Hence virtual dissections have to be done using computer-aided programmes.

Course: PART III – CORE PRACTICAL I (Based on Core I, II and III)	Course Code: 220ZPI
Semester: I & II	No. of Credits: 4
No. of hours : (30 + 30)	P:R 52: 8
Internal components Marks: 40	ESE Max. Marks: 60

(P: Practical; R: Record)

Course Objectives:

- To recognize the general and distinguishing characters of Invertebrates and Vertebrates.
- To illustrate the organization, relate structure with functions of Invertebrates and Vertebrates and to inculcate the practical skills.
- To understand the habitat, adaptations and the biodiversity of animals.
- To equip the students with the knowledge about the biological significance of Invertebrates and Vertebrates.
- To expertise the culture of earthworms.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	identify the Nonchordates and Chordates	R
CO2	recognise the taxonomy of Nonchordates and Chordates	R
CO3	gain knowledge about biodiversity of organisms	U
CO4	interpret the significance of specific structure and function	U
CO5	implement the biological significance of Nonchordates and Chordates	A
CO6	evaluate the conservation awareness of the biosphere by field visit	A

R-Remembrance U –Understanding A-Apply

Syllabus:

1. Identify and comment on the virtual specimen/ virtual dissection exposed in Monitor/dissect the virtual specimen, label and comment on it with suitable diagrams.

1. Cockroach – Mouth parts, Digestive system and Nervous system
2. Fish - Digestive system

2. SPOTTERS: Study of Invertebrate and Chordate forms which belongs to different Phyla with special reference to the following aspects.

I. Classify giving reasons.

- | | | |
|----------------|------------------|-------------------------|
| 1. Paramecium | 2. Obelia colony | 3. <i>Taenia solium</i> |
| 4. Scorpion | 5. Sepia | 6. Hippocampus |
| 7. Ichthyophis | 8. Calotes | 9. King Fisher |
| | | 10. Loris. |

II. Draw Labelled Sketch

- | | | |
|------------------------------|--|-------------------|
| 1. <i>Taenia solium</i> T.S. | 2. Ascaris T.S. | 3. Earthworm T.S. |
| 4. Amphioxus T.S. | 5. Pigeon – Pelvic girdle with synsacrum | |
| 6. Hind Limb of Pigeon. | | |

III. Relate Structure and Function

- | | | |
|-----------------------------|---------------------|---------------------------|
| 1. Sponge – Spicules | 2. Tapeworm- Scolex | 3. Mosquito – Mouth parts |
| 4. Nereis – Parapodium | 5. Pila – Radula | 6. Shark - Placoid scales |
| 7. Snake – Poison Apparatus | 8. Quill feather | |

IV. Comment on Respiration

- | | | |
|-------------|-------------------------|-------------------|
| 1. Ascaris | 2. Scorpion – book lung | 3. Pila |
| 4. Sea star | 5. Anabas | 6. Frog – tadpole |

V. Comment on Biological Significance:

- | | | |
|------------------|--------------|---------------|
| 1. Physalia | 2. Peripatus | 3. Bipinnaria |
| 4. Balanoglossus | 5. Sphenodon | 6. Chaemeleon |
| 7. Archaeopteryx | | |

1. Culture of unicellular organisms (Paramecium and Euglena)
2. Culture of Multicellular organism (Earthworm)

4. Field visit

1. Field visit report and *viva voce* on Biodiversity of the campus/field (to be done by a group of five students).
2. Submission of written / typed report preferably with photographs/ tables/ graphs.

5. Record

The work done in laboratory must be submitted for the practical examination.

Note: Comprehensive Examination by External and Internal Examiners.

Books for Reference:

Name of the Book	Authors	Publishers with Edition
The text book of practical Zoology Invertebrate	Lal. S.S.	Rastogi Publication Meerut (2004)
The text book of practical Zoology Chordates	Lal. S.S.	Rastogi Publication Meerut (2004)

E-Resources: (Web resources & E-books)

- <https://www.youtube.com/watch?v=VTUX5CkKXOY>
- <https://www.youtube.com/watch?v=Xc9JE8mmFig>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO 1	H	M	L	M	M	R
CO 2	H	H	L	M	M	R
CO 3	H	H	M	M	M	U
CO 4	H	H	M	M	L	U
CO 5	H	H	L	M	L	A
CO 6	H	H	L	M	L	A

Content Delivery Methods

1. Class room lecture
2. Using LCD
3. Laboratory class and demonstration
4. Museum specimens / Microscopic slides
5. Charts / Models / Pictures / instruments / apparatus
6. Virtual Practical
7. demonstration
8. Field visit
9. Visit to Zoological park and Museum

Course Evaluation Methods:

Direct Methods	Indirect Methods
Lab Performance Record Model Exam	Course Exit Survey

Internal Assessment components:

Components	Lab Performance	Record	Model Exam	Attendance	Total
Marks	15	15	8	2	40

Marks for Internal Assessment components:

Bloom's Category	Lab Performance (15 marks)	Record (15 marks)	Model practical Examination (8 marks)
R	Punctuality (3 mark)	Punctuality (4 marks)	Model practical Examination marks converted to 8
U	Experimental skill (8marks)	Neatness and accuracy (3 marks)	
A	Observation note (4 marks)	Drawing and writing (8 marks)	

Question paper pattern for End Semester Practical**Core Practical I : 60 Marks**

S. No	Bloom's Category	Name of the Practical	Maximum 60 Marks
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1	R	Major Practical	15
2	U	Spotters	4X5=20
3	A	Minor Practical	5
4	A	Field visit (Report Submission and Viva voce)	10
5	A	Record	10
Total			60

Course Designed by	Dr. K. Shobana	
Course Reviewed by	Dr. (Mrs.) S. Kalaichelvi	
Head of the Department	Dr. (Mrs.) S. Kalaichelvi (i/c)	

B.Sc. ZOOLOGY
SEMESTER IV
 (For the students admitted during the academic year 2020-2021 only)

Course: PART III – CORE PRACTICAL II (Based on Core III and IV)	Course Code: 420ZP2
Semester: I & II	No. of Credits: 4
No. of hours : (30 + 30)	P:R 52:8
Internal components Marks: 40	ESE Max. Marks: 60

(P:Practical, R: Record)

Course Objectives:

- To understand the cell and cell organelles
- To learn techniques in molecular biology.
- To instil knowledge about the food components.
- To gain knowledge about the physico-chemical parameters of water.
- To inculcate practical skill in water quality management.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Describe the structure and function of cell and cell organells, basic concepts of cell division and the special types of chromosomes.	U
CO2	Analyse the qualitative and quantitative detection of carbohydrates, proteins and lipids.	A
CO3	Analyse the Physicochemical properties of water	A
CO4	Explain the characteristics of symbiosis and antagonism.	A
CO5	Relate the structure and functions of homologous and analogous organs, evolutionary evidences of man and significance of fossils.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Cell biology

1. Squash preparation – Mitosis - Onion root tip.
Meiosis- Grass hopper or Cockroach
2. Smear - Buccal cells of man.

Biochemistry

1. Qualitative detection of Carbohydrates, Proteins and Lipids
2. Quantitative estimation of Carbohydrates, Proteins

Environmental Biology

1. Estimation of dissolved oxygen of river and sewage effluent.
2. Estimation of free Carbon-di-oxide of water samples.
3. Estimation of salinity in different water samples.
4. Estimation of primary productivity in different samples of water.
5. Identification of Planktons
6. Water quality analysis of different samples of drinking water – pH and Total solids.

SPOTTERS

Cell Biology

1. Mitosis: Prophase, Metaphase, Anaphase and Telophase.
2. Cell organelles: Mitochondria and Golgi complex.
3. Giant chromosomes, DNA double helix and t-RNA structure.

Environmental Biology

- | | | |
|----------------|-----------------------------------|----------------------|
| 1. Seechi disc | 2. Sea anemone on gastropod shell | 3. Sacculina on crab |
| 4. Nauplius | 5. Vorticella | 6. Daphnia |

Evolution

1. Homologous Organs (Forelimb and Hind limb skeleton)
2. Analogous Organs (Wings of Butterfly, bird, bat)
3. Coccox
4. Vermiform appendix

Identification of fossils

1. Actual remains
2. Natural moulds

Record

The work done in laboratory must be submitted.

Note: Comprehensive Examination by External and Internal Examiners.

Books for Reference:

Name of the Book	Authors	Publishers with Edition
Practical Zoology Vol.3	N.Arumugam and others	Saras Publication Nagercovil (2013)
Experimental procedures in Life Sciences	S.Rajan and P. Selvi Christy	Anjanaa Book House (2011)

E-Resources: (Web resources & E-books)

- <https://www.youtube.com/watch?v=VJ678ceiiV0>
- <https://www.youtube.com/watch?v=TDFbtEwbmz0>
- <https://www.youtube.com/watch?v=8UiuE7Xx518>

Mapping of Course outcome with POS

CO	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	H	H	M	H	H	U
CO2	H	H	H	M	H	A
CO3	H	H	H	H	M	A
CO4	H	H	M	H	H	A
CO5	H	H	H	M	H	A

Internal Assessment components:

Components	Lab Performance	Record	Model Exam	Attendance	Total
Marks	15	15	8	2	40

Question paper pattern for End Semester Practical**Core Practical II: 60 Marks**

S.No	Bloom's Category	Name of the Practical	Maximum 60 Marks
1	A	Major Practical	20

2	A	Minor Practical	10
3	U	Spotters	5 x4=20
4	A	Record	10
		Total	60 Marks

B.SC. ZOOLOGY SEMESTER VI

(For the students admitted during the academic year 2020-2021 only)

Course: PART III – Core Practical III (Based on Core VI, VII, VIII, X, XI & XII)	Course Code: 620ZP3
Semester: V & VI	No. of Credits: 4
No. of hours : (60 +60)	P:R 104:16
Internal components Marks: 40	ESE Max. Marks: 60

(P:Practical, R: Record)

Course Objectives:

- To acquire practical knowledge in physiology.
- To understand the sterilization, staining and isolation techniques.
- To instil knowledge about blood grouping.
- To gain knowledge about the calculation of mean, median, mode and Genome sequences.
- To learn microbiological techniques.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	estimate oxygen consumption in fish, qualitative detection of excretory products and preparation of haemin crystal in human blood and physiological functions	A
CO2	apply techniques in sterilization, staining and isolation of DNA and separation of proteins by electrophoresis and biotechnological applications	A
CO3	explain Mendelian character and blood grouping and Rh factors in man and observe the frog and chick embryo stages.	A
CO4	Calculate central measures of tendency , computer components and study of genomic sequences	A
CO5	apply culture techniques in hanging drop, bread mould, culture and identification of yeast, Distribution of microbes in soil and water and methylene blue reductase test for milk.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Physiology

1. Oxygen consumption in fish
2. Qualitative detection of Excretory Products (Ammonia, Urea and Uric Acids).
3. Preparation of haemin crystal in human blood.

Biotechnology

1. Techniques of sterilization using autoclave
2. Preparation of nutrient broth.
3. Gram staining
4. Isolation of DNA (Demonstration Only)
5. Separation of proteins by electrophoresis

Genetics

1. Study of Mendelian characters (Class samples – eye colour, hair, tongue rolling and folding, use of hands)
2. Blood grouping and Rh factor in man
3. Localization of Barr body in buccal epithelial cells.

Biostatistics, Bioinformatics and Computer Applications

1. Calculation of mean, median and standard deviation from the sample given (Shells/leaves-length).
2. Computer components, usage of computer internet and E-mail Download and study at least two samples of Genome sequences.

Microbiology

1. Hanging drop preparation with buttermilk
2. Bread mould preparation
3. Culture and identification of yeast
4. Distribution of microbes in soil and water. (Demonstration Only)
5. Methylene blue reductase test for milk

SPOTTERS**I. Physiology**

- | | | |
|--------------------------|--------------------------|--------------------------|
| 1. Muscle – twitch curve | 2. ECG curve | 3. Mammalian heart |
| 4. Mammalian kidney | 5. T.S. of Thyroid gland | 6. T.S. of Adrenal gland |

II. Biotechnology

- | | | | |
|----------------------------|------------------|---------------|--------------|
| 1. Plasmid | 2. Autoclave | 3. Centrifuge | 4. Fermentor |
| 5. Laminar airflow chamber | 6. BOD incubator | 7. Spirulina | |

III. Biostatistics, Bioinformatics and Computer Applications

- | | | |
|----------------------|-------------------------------|---|
| 1. Graph sheet (use) | 2. Probability (coin tossing) | 3. Parts of computer ,Copies of Genome, Sequences DNA and Proteins. |
|----------------------|-------------------------------|---|

IV. Genetics

- | | |
|---------------|-------------------------|
| 1. Drosophila | 2. Blood Grouping serum |
|---------------|-------------------------|

V. Developmental Biology

1. Frog – Gastrula with yolk – plug stage
2. Hen's egg
3. Chick development (24 hours stage, 48 hours stage & 72 hours stage)
4. Placenta of man

VI. Microbiology

- | | | | |
|----------|------------|-----------|---------------------|
| 1. Cocci | 2. Bacilli | 3. Fungus | 4. T4 Bacteriophage |
|----------|------------|-----------|---------------------|

Record The work done in laboratory must be submitted.

Note: Comprehensive Examination by External and Internal Examiners.

Books for Reference:

Name of the Book	Authors	Publishers with Edition
Practical Zoology Volume 3	Dr.Jayasurya <i>et,al.</i>	Saras Publications, A.R.P. Camp Road, Periavilai, Nagarkovil. 2013.
Advanced Practical Zoology	J.Sinha <i>et, al.</i>	Arunabha Sen, Book and Allied (p) Ltd.Kolkata. 2014.

E-Resources: (Web resources & E-books)

- <https://www.khanacademy.org/test-prep/mcat/cells/prokaryotes-bacteria/v/bacterial-characteristics-gram-staining>
- <https://www.youtube.com/watch?v=ujzSmsmg7ok>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	H	H	L	H	-	A
CO2	H	H	L	H	-	A
CO3	H	H	L	H	-	A
CO4	H	H	L	H	-	A
CO5	H	H	L	H	-	A

Internal Assessment components:

Components	Lab Performance	Record	Model practical Examination	Attendance	Total
Marks	15	15	8	2	40

Question paper pattern for End Semester Practical**Core Practical III: 60 Marks**

S.No	Bloom's Category	Name of the Practical	Maximum 60 Marks
1	A	Major Practical	20
2	A	Minor Practical	10
3	U	Spotters	5 x4=20
4	A	Record	10
		Total	60 Marks

B.SC. ZOOLOGY**SEMESTER VI****(For the students admitted during the academic year 2020-2021 only)**

Course: PART III – Elective Practical (Based on Elective CLT & Sericulture)	Course Code: 620ZE5
Semester: V & VI	No. of Credits: 2
No. of hours : (30 +30)	P:R 52:8
Internal components Marks: 20	ESE Max. Marks: 30

(P:Practical, R: Record)**Course Objectives:**

- To learn clinical laboratory technique.
- To understand the haematology.
- To gain knowledge about the clinical laboratory technique.
- To understand the cultivation of mulberry plant.

- To acquire knowledge about the life cycle of silkworm and sericulture.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	develop skill in hematological practicals of RBC and WBC count, Hb estimation, Bleeding, Clotting time and measurement of BP and heart beat.	A
CO2	develop skill in urine analysis practicals of Specific gravity, Albumen, Sugar, Blood, Bile salt and Bile pigment,	A
CO3	Recognize the Clinical laboratory techniques spotters	A
CO4	Recognize the Sericulture spotters	A
CO5	The practical work done in laboratory must be drawn and submitted as record note.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Clinical Laboratory Techniques

Haematology

- RBC Count
- WBC Count
- Hb Estimation
- BT (Bleeding time)
- CT (Clotting time)
- Measurement of blood pressure and heart beat (Demonstration only)

Urine Analysis (Qualitative)

- Specific gravity
- Albumen
- Sugar
- Bile salt
- Blood
- Bile pigment – (Bilirubin and Urobilinogen)
- Urine analysis for the presence of Blood cells

SPOTTERS

Clinical Laboratory Techniques

- Albuminometer
- Ryles tube
- Haemocytometer
- Folin -Wu tube
- Westergren apparatus
- Urinometer
- Haemometer
- Carwardine Saccharometer
- Sphygmomanometer
- Stethoscope

Sericulture

- Bombyx mori*
- Tasar
- Eri
- Muga
- Life cycle of silk moth
- Egg cord
- Cocoon
- Mulberry leaf
- Mountage
- Silk gland
- Silk thread
- Rearing stand
- Rearing shed
- Netrika

Record

The work done in laboratory must be submitted.

Note: Comprehensive Examination by External and Internal Examiners.

Books for Reference:

Name of the Book	Authors	Publishers with Edition
Medical Laboratory Techniques	Kanaiah Mukerjii	Tata MC Graw Hill publishing

Volume I, II & III		Company, 4 th edition, 2006
Medical Laboratory Technology	Dr. Ramnik Sood M.D	Jaypee Brothers, Medical publishers, 2003.
An Introduction to Sericulture	G. Ganga and J. Sulochana Chetty,	Vijay pramlani fro oxford and ibh publishing co.pvt.ltd. 2005

E-Resources: (Web resources & E-books)

- <https://www.youtube.com/watch?v=fr043wF1zhA>
- <https://labtestsonline.org/tests/white-blood-cell-count-wbc>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	H	H	H	H	M	A
CO2	H	M	H	H	H	A
CO3	H	M	M	H	H	A
CO4	H	M	M	H	H	A
CO5	H	M	M	H	H	A

Internal Assessment components:

Components	Lab Performance	Record	Model Exam	Attendance	Total
Marks	8	5	5	2	20

Marks for Internal Assessment components:

Bloom's Category	Lab Performance (8 marks)	Record (5 marks)	Model practical Examination (5 marks)
R	Punctuality (1 mark)	Punctuality (1 mark)	Model practical Examination marks converted to 5
U	Experimental skill (4 mark)	Neatness and accuracy (1 mark)	
A	Observation note (3 mark)	Drawing and writing (3 mark)	

**Question paper pattern for End Semester Practical Examination
Part III- Elective Practical**

Maximum 30 Marks		
Question :1	Major Practical	10
Question :2	Minor Practical	5
Question :3	Spotters (5 Spotters)	5X2=10
Question :4	Record	5

**B.Sc. ZOOLOGY
SEMESTER VI**

(For the students admitted during the academic year 2020-2021 only)

Course: PART III – Elective Practical (Based on Elective Bioinstrumentation & Pest and their Control)	Course Code: 620ZE6
Semester: V & VI	No. of Credits: 2
No. of hours : (30 +30)	P:R 52:8
Internal components Marks: 20	ESE Max. Marks:30

(P:Practical, R: Record)

Course Objectives:

1. To learn biological instrumentation.
2. To understand the haematology.
3. To gain knowledge about various biological instruments.
4. To gain knowledge about the modern instruments.
5. To acquire knowledge about the types of pests.
6. To get hands on training on handling stethoscope and BP apparatus.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	Do clinical techniques practicals of RBC and WBC count done.	A
CO2	Do clinical techniques practicals of Hb estimation and measurement of BP.	A
CO3	Recognize the Clinical laboratory techniques spotters	A
CO4	. Recognize the Pest and their control spotters	A
CO5	The practical work done in laboratory must be submitted as record note for the practical examination.	A

R-Remembrance U –Understanding A-Apply

Syllabus:

Biological Instrumentation

Haematology

1. RBC Count
2. WBC Count
1. Hb Estimation
2. Measurement of blood pressure and heart beat (Demonstration only)
3. Blotting Techniques

SPOTTERS**Biological Instrumentation**

- | | | |
|------------------|----------------|--------------------|
| 1. Colorimeter | 2. pH meter | 3. Haemocytometer |
| 4. Haemometer | 5. Centrifuge | 6. Electrophoresis |
| 7. Haemometer | 8. Stethoscope | 9. PCR |
| 10. Culture rack | 11. ECG | |

Pests and their Control

- | | | | |
|----------------|------------------------------|---------------|---------------|
| 1. Rice weevil | 2. <i>Oryctes Rhinoceros</i> | 3. Stem borer | 4. Leaf borer |
| 5. Ticks | 6. Aphids | 7. Cockroach | |
| 8. Bed Bug | 9. Mites | 10. House fly | |

Record

The work done in laboratory must be submitted.

Note: Comprehensive Examination by External and Internal Examiners.

Books for Reference:

Name of the Book	Authors	Publishers with Edition
Medical Laboratory Techniques Volume I, II & III	Kanaiah Mukerjii	Tata MC Graw Hill publishing Company, 4 th edition, 2006
Medical Laboratory Technology	Dr. Ramnik Sood M.D	Jaypee Brothers, Medical publishers, 2003.
Elements of Economic Entomology	Vasantharaj David B	Popular Book Depot, Chennai – 15. (2001)

E-Resources: (Web resources & E-books)

- <https://www.youtube.com/watch?v=fr043wF1zhA>
- <https://labtestsonline.org/tests/white-blood-cell-count-wbc>

Mapping of Course outcome with POs

CO	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	H	M	H	M	M	A
CO2	H	M	H	M	M	A
CO3	H	M	H	M	M	A
CO4	H	M	H	M	M	A
CO5	H	M	H	M	M	A

Internal Assessment components:

Components	Lab Performance	Record	Model Exam	Attendance	Total
Marks	8	5	5	2	20

Marks for Internal Assessment components:

Bloom's Category	Lab Performance (8 marks)	Record (5 marks)	Model practical Examination (5 marks)
R	Punctuality (1 mark)	Punctuality (1 mark)	Model practical Examination marks converted to 5

U	Experimental skill (4 mark)	Neatness and accuracy (1 mark)	
A	Observation note (3 mark)	Drawing and writing (3 mark)	

**Question paper pattern for End Semester Practical Examination
Part III- Elective Practical**

Maximum 30 Marks		
Question :1	Major Practical	10
Question :2	Minor Practical	5
Question :3	Spotters (5 Spotters)	5X2=10
Question :4	Record	5

**B.Sc. ZOOLOGY
SEMESTER VI**

(For the students admitted during the academic year 2020-2021 only)

Course: PART III - Elective II – PESTS AND THEIR CONTROL	Course Code: 620ZE4
Semester: VI	No. of Credits: 4
No. of hours : 75	C:T 65:10
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Course Objectives:

- To gain knowledge about types of pest.
- To impart knowledge in bionomics and control measures.
- To create awareness on pests of stored products and house hold pest.
- To enrich knowledge in pest management techniques.
- To learn the basics in pesticides and their applications.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO 1	explain the types of pest, types of damage to plants, causes for pest status, pest surveillance, assessment of insect population	U
CO 2	discuss bionomics and control of pest of rice, sugarcane, coconut, groundnut, cotton and brinjal.	U
CO 3	explain the pests of stored products and bionomics and control of household pests.	U
CO 4	explain the methods and principles of pest control	U
CO 5	discuss organic and inorganic pesticides, methods of pesticide applications and first aid precautions	U

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I	(13hrs)
---------------	----------------

1. Introduction, definition of the term pest, types of pest.
2. Types of damage to plants by insects.
3. Causes of insects assuming pest status.
4. Pest surveillance and forecasting pest outbreak.
5. *Assessment of insect population.
6. Estimation of damage caused by insect pests to crops.

Unit II**(13hrs)****(3 Examples with bionomics and control)****I. Pest of Rice-**

1. The rice stem borer (*Tryporyza incertulas*)
2. Dark headed borer (*Chilo polychysa*)
3. The swarming caterpillar (*Spodoptera mauritia*)

II. Pest of Sugarcane

1. The shoot borer (*Chilo infuscatellus*)
2. White grub (*Holotricha consanguinea*)
3. The sugarcane leaf hopper (*Pyrilla prpusilla*)

III. Pest of Coconut

1. The rhinoceros beetle(*Oryctes rhinoceros*)
2. The red palm weevil(*Rhynchophorus ferruginetus*)
3. The black headed caterpillar (*Nephantis serinopa*)

IV. Pests of oil seeds- ground nut

1. The red hairy caterpillar (*Amascta albistriga*)
2. The surul poochi or leaf miner (*Stomopteryx subsecivella*)
3. The stem borer or verpoochi (*Sphenoptera perotetti*)

V. Pest of fibre crop – cotton

1. The cotton aphid (*Aphis gossypii*)
2. The cotton stem weevil (*Pempherulus affinis*)
3. The spotted bollworms (*Earias insulana*)

VI. Pests of vegetables –Brinjal

1. The shoot and fruit borer (*Leucinodes orbonalis*)
2. The spotted leaf beetle (*Epilachna vigintictopunctata*)
3. The grey weevil (*Myloccerus subfasciatus*)

Unit III**(13 hrs)**

1. Insect pests of stored products- internal feeders and external feeders.
2. Bionomics and control of house hold pests such as *mosquito, housefly, cockroach ad bed bug.

Unit IV**(13hrs)**

Methods and principles of pest control:

1. *Natural control
2. Artificial control by insects (Prophylactic and direct methods) (brief account only)
3. Cultural method
4. Mechanical methods.
5. *Biological control by insects (2 examples by disease through bacteria, virus, protozoa) - Advantages of biological control.
6. Recent trends in pest control (brief account only)
 - a) Ionizing radiations
 - b) chemosterilants
 - c) Hormones in pest control
 - d) use of genetic manipulation.
 - e) Insect attractants (Pheromones)
 - f) Insect repellents.

Unit V**(13hrs)**

1. Outline classification of pesticides with 2 examples for each.
2. Organo chlorine compounds (DDT, BHC)
3. Organic compounds of plant origin.
4. Methods of pesticides application (Dusting, spraying, aircraft application)- brief account only.
5. First aid precaution in applying insecticides.

Starred and underlined topics are for self study*Books for study:**

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III, IV & V	Elements of Economic Entomology	Vasantharaj David B	Popular Book Depot, Chennai – 15. (2001)

Books for Reference:

Name of the Book	Authors	Publishers with Edition
General and applied Entomology.	Nair K.K.Anandhakrishnan TN & David BV	Tata Mc.Graw Hill Publ. Delhi.
Imms AD Text book of Entomology Vol. I & II Ed.. ELBS	By Richard and Owen	ELBS

E-Resources: (Web resources & E-books)

- <https://nptel.ac.in/courses/126104003/LectureNotes/Week-1,02%20Insect%20classification%20based%20on%20economic%20importance.pdf>
- <https://nptel.ac.in/courses/126104003/LectureNotes/Week-6 Paddy IPM lect3.pdf>
- <https://nptel.ac.in/courses/126104003/LectureNotes/Week-7 Sugarcane IPM lect5.pdf>
- <https://nptel.ac.in/courses/126104003/LectureNotes/Week4 pest mang radiation lect 4.pdf>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO 1	H	H	L	M	-	U
CO 2	H	H	L	M	-	U
CO 3	H	H	L	M	-	U
CO 4	H	H	L	M	-	U
CO 5	H	H	L	M	-	U

Internal Assessment components:

Components	CIA	Assignment	Objective Type Questions	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10X1=10 marks)
Section B	Either or Type - 5 Questions (5X4= 20 marks)
Section C	Either or Type - 5 Questions (5X9= 45 marks)

**B.Sc. ZOOLOGY
SEMESTER VI**

(For the students admitted during the academic year 2020-2021 only)

Course: PART III - CORE X - GENETICS	Course Code: 620Z10
Semester: VI	No. of Credits: 4
No. of hours : 90	C:T 78:12
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Syllabus:

Unit I: Mendel's laws of Inheritance	(16 hrs)
<ol style="list-style-type: none"> 1. Mendelian principles – Mendel's Laws – Law of dominance, Law of segregation and Law of Independent Assortment - Monohybrid and Dihybrid experiments. 2. Alleles – Homozygote- Heterozygote – Hybrid – Genotype and Phenotype - Back cross – Test cross. 3. Genetic Interaction: Complementary genes, Complete dominance, Lethal genes, Incomplete dominance, Co-dominance, Epistasis. 4. Multiple alleles - Human blood group and Rh factor - Coat colour in Rabbit. 	
Unit II : Linkage and Crossing over	(15 hrs)
<ol style="list-style-type: none"> 1. Linkage in drosophila. 2. Crossing over: Types of crossing over - Significance and Factors affecting crossing over – Crossing over in Drosophila. 3. Cytological proof for crossing over: Stern's Experiment. 4. *Sex - Determination in Man and Drosophila. 5. Sex-linked inheritance in Drosophila. 	
Unit III: Cytogenetics	(16 hrs)
<ol style="list-style-type: none"> 1. Gene and Gene Concept: Size of a Gene – Gene expression – Gene Concept – Functions of Gene. 2. Mutation – Types of Mutation - Gene mutation - Detection of mutation by CIB technique - Mutagens 3. Chromosomal Aberration (Syndromes) — Down's syndrome (Mangolian idiocy) – Klinefelter's syndrome – Turner's syndrome. 	
Unit IV: Human Genetics	(16 hrs)

1. Sex linked inheritance in man: Colour blindness, Haemophilia.
2. Multiple Gene Inheritance - Skin colour in man.
3. Inborn errors of metabolism – Autosomes and Sex chromosomes - Sickle cell anaemia- Phenylketonuria, Alkaptonuria and Albinism.
4. *Twins – Identical twins – Fraternal twins – Siamese twins.
5. Eugenics, Euthenics and Euphenics, Pedigree analysis genetic counselling

Unit V : Microbial and Population Genetics (15 hrs)

1. Recombination in bacteria and virus.
2. Extra chromosomal inheritance in paramecium
3. *Population Genetics: Gene pool, Gene frequency and Genotype frequency.
4. Genetic equilibrium and Hardy Weinberg law.

****Starred and underlined topics are for self-study.**

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III, IV & V	A textbook of Genetics	Veerabala Rastogi	Kedarnath and Ramnath Publication, 2007
I,II, III, IV & V	Genetics	Dr. R.P. Meyyan	Saras Publication, Revised Edition, 2010

Books for Reference:

Name of the Book	Authors	Publishers with Edition
Principles of Genetics	Sinnot E.W. Dunn L.C. and Dobzhansky T.H.	Tata Mc Graw Publishers, 1958
Genetics	P.S.Verma and V.K. Agarwal	S.Chand & CO, Revised Edition, 2006
Principles of Genetics	Gardner E.J.	Wiley Eastern Private Ltd., 3 rd Edition, 1967

E-Resources: (Web resources & E-books)

<http://eagri.org/eagri50/GBPR111/index.html>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	H	H	M	M	M	U
CO2	H	H	M	M	M	U
CO3	H	H	M	M	M	U
CO4	H	H	M	M	M	U
CO5	H	H	M	M	M	U

Internal Assessment components:

Components	CIA	Assignment	Objective type questions	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10X1=10 marks)
Section B	Either or Type - 5 Questions (5X4= 20 marks)

Section C	Either or Type - 5 Questions (5X9= 45 marks)
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**COURSES UNDER ENTREPRENEURSHIP
B.Sc. ZOOLOGY
SEMESTER VI**

(For the students admitted during the academic year 2020-2021 only)

Course: PART III Core XII– MICROBIOLOGY	Course Code: 620Z12
Semester: VI	No. of Credits: 4
No. of hours : 75	C:T 65:10
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Course Objectives:

- To impart knowledge in diversity of prokaryotic and eukaryotic microorganisms.
- To enable the students to gain knowledge in applications of microbes in various fields.
- To appreciate culture techniques skills and research skills in microbiology.
- To acquire knowledge on food poisoning and food preservation.
- To realize the importance of microbes in dairy farms
- To gain knowledge about various microbial diseases and their control.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	describe the history and scope of microbiology and structure of Bacteria and their reproduction.	U
CO2	define techniques in culturing, isolation and staining.	U
CO3	explain food microorganisms and preservation of food	U
CO4	explain dairy microbiology and describe the diseases of cattle and their control	U
CO5	discuss bacterial, viral and fungal diseases and their control	U

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I:	(13 Hrs)
<ol style="list-style-type: none"> 1. History and scope of microbiology 2. General Structure of Bacteria 3. Asexual reproduction – Binary fission and fragmentation. 4. Cyanobacteria and its economic importance. 	

Unit II: Nutrition and Culture of Bacteria	(13 Hrs)
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1. Nutritional types of bacteria and Nutritional requirements.
2. Culture media – Types of culture medium – Composition of typical culture medium – liquid medium (or) broth, semisolid medium, solid medium, complex, selective medium, differential medium, enrichment medium.
3. Culture technique – Batch culture, continuous culture – Methods of growing microorganisms - broth culture, agar plate, slant and stab.
4. Isolation of pure culture – streak plate, pour plate, spread plate method.
5. Wet mount technique- Staining - differential staining, acid fast staining.

Unit III: Food Microbiology	(13 Hrs)
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1. Microorganisms of food – Common food items – sources of microorganisms found in food – Microbial examination of foods.
2. Factors that influence Microbial growth – Microbial spoilage of foods – Biochemical changes of food spoilage.
3. Food poisoning – types of food poisoning – food intoxication – Botulism, Staphylococcal food poisoning, infantile Gastroenteritis and Travellers diarrhoea.
4. Food preservation – Methods of foods preservation – Prevention of food infection and food poisoning.

Unit IV: Dairy Microbiology	(13 Hrs)
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1. Introduction Sources of microorganisms in milk.
2. Temperature Characteristics of bacteria in milk, pathogenic type of bacteria in milk.
3. Bacterial examination of milk.
4. Preservation and products of milk
5. Microbial diseases of Cattle and control measures.

Unit V: Medical Microbiology	(13 Hrs)
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1. Bacterial diseases – Respiratory diseases – Whooping cough, Tuberculosis - Digestive tract diseases – Cholera and Typhoid - Genitourinary tract diseases – Gonorrhoea and Syphilis.
2. Viral diseases: Rabies, Viral Hepatitis type A and Poliomyelitis, **COVID-19**
3. Fungal diseases.

***Starred and underlined topics are for self study.**

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III, IV & V	Microbiology	N.Arumugam	Saras Publication, (2010)

Books for Reference:

Name of the Book	Authors	Publishers with Edition
General Microbiology	Power	Himalaya Publishing house, II Edition (2003)
Microbiology	P.D. Sharma	Rastogi Publications, II Edition (2000).

E-Resources: (Web resources & E-books)

- <https://nptel.ac.in/courses/102103015/>

- <http://www.cen.ulaval.ca/warwickvincent/PDFfiles/228.pdf>
- <https://nptel.ac.in/courses/102103015/module5/lec1/7.html>
- http://www.srmuniv.ac.in/sites/default/files/downloads/food_poisoning.pdf
- <https://nptel.ac.in/courses/102103039/43>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	H	H	M	H	M	R
CO2	H	H	M	H	M	A
CO3	H	H	M	H	M	A
CO4	H	H	M	H	M	U
CO5	H	H	M	H	M	R

Internal Assessment components:

Components	CIA	Assignment	Objective type questions	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10X1=10 marks)
Section B	Either or Type - 5 Questions (5X4= 20 marks)
Section C	Either or Type - 5 Questions (5X9= 45 marks)

B.SC. ZOOLOGY SEMESTER VI

(For the students admitted during the academic year 2020-2021 only)

Course: PART III - Elective II - SERICULTURE	Course Code: 620ZE3
Semester: VI	No. of Credits: 4
No. of hours : 75	C:T 65:10
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Course Objectives:

- To gain knowledge about mulberry cultivation.
- To enable the students to learn the basics of Silkworm rearing technology.
- To understand the facilities of rearing – rearing house and rearing equipments
- To create knowledge about the reeling process.
- To instil knowledge about trade and export of silk.
- To create awareness on self-employment opportunities

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	discuss history, economic importance of sericulture architecture, propagation and irrigation of mulberry plants.	U
CO2	explain types of pruning, harvesting of mulberry leaves and varieties of silk worm, life cycle	U
CO3	describe the morphology and structure of silk gland in <i>Bombyx mori</i> and also rearing facilities in silk worm.	U
CO4	discuss rearing of young age and late age silkworms,	U

	mounting, stifling and marketing of cocoons.	
CO5	explain deflossing, reeling, re-reeling of cocoons and pest management in silkworm	U

R-Remembrance U –Understanding A-Apply**Syllabus:**

Unit I	(13 hrs)
<ol style="list-style-type: none"> 1. Definition and history of Sericulture 2. <u>*Economic importance of Sericulture</u> 3. Architecture of mulberry plant <ol style="list-style-type: none"> a) Plant height b) Stem c) Leaves d) Inflorescence 4. Propagation - Methods of propagation 5. Frequency and methods of irrigation. 	

Unit II	(13 hrs)
<ol style="list-style-type: none"> 1. <u>*Pruning – Types of pruning</u> 2. Harvesting of leaves, time of harvesting and preservation of leaves 3. Varieties of silkworm ((Mulberry, Tasar, Eri and Muga) 4. Life cycle of <i>Bombyx mori</i>. 	

Unit III	(13 hrs)
<ol style="list-style-type: none"> 1. Morphology of Silkworm - Structure of silk gland 2. Facilities of rearing – rearing house and rearing equipments. 3. Optimum environmental conditions for rearing. 4. Feeding – bed cleaning – spacing. 	

Unit IV	(13 hrs)
<ol style="list-style-type: none"> 1. Rearing of young age and late age silkworms. 2. Spinning - Mounting 3. Harvesting of cocoons. 4. Cocoon Marketing – transport of cocoons – physical characters of cocoons considered for commercial purposes – cocoon markets. 5. Stifling of cocoons (sun drying, steam stifling only). 	

Unit V	(13 hrs)
<ol style="list-style-type: none"> 1. Deflossing 2. <u>*Reeling appliances – Country Charka, Domestic basin, Cottage basin and Filatures</u> 3. Re-reeling (brief account) 4. Diseases and pests of silk worm <ol style="list-style-type: none"> a. Pebrine b. Flacherie c. Grasserie d. Muscardine (White muscardine) e. Uzifly 	

***Starred and underlined topics are for self-study**

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III,	An Introduction to	G.Ganga and	2005

IV & V	Sericulture	J.Sulochana Chetty,	
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Books for Reference:

Name of the Book	Authors	Publishers with Edition
Sericulture manual 1, 2, 3	Government of India,	Oxford and IBH Publishing Company, Bombay, 1998.
A textbook of Sericulture	Madan Mohan Rao,	B.S.publisher, Hyderabad. 2005
Hand book of Sericulture Technologies	- S.B Dandin, Jayant Jayaswal and K.Giridhar	CSB, Bangalore., 2003

E-Resources: (Web resources & E-books)

- <https://nptel.ac.in/courses/102103015/module3/lec2/2.html>
- <http://egyankosh.ac.in/bitstream/123456789/9070/1/Unit-1.pdf>
- http://agritech.tnau.ac.in/sericulture/seri_mulberry%20cultivation.html
- https://hbmahesh.weebly.com/uploads/3/4/2/2/3422804/1.cocoon_stifling.pdf
- http://agritech.tnau.ac.in/sericulture/disease%20mgt_silkworm.html

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	H	H	H	M	-	U
CO2	H	H	H	M	-	U
CO3	H	H	H	M	-	U
CO4	H	H	H	M	-	U
CO5	H	H	H	M	-	U

Internal Assessment components:

Components	CIA	Assignment	Online Test	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10X1=10 marks)
Section B	Either or Type - 5 Questions (5X4= 20 marks)
Section C	Either or Type - 5 Questions (5X9= 45 marks)

**B.SC. ZOOLOGY
SEMESTER VI**

(For the students admitted during the academic year 2020-2021 only)

Course: PART IV – SKILL ENHANCEMENT COURSE IV – INTERNSHIP	Course Code: 620ZS4
Semester: V & VI	No. of Credits: 3
No. of hours : 45	C:T 15:30
Internal components Marks: - 75	ESE Max. Marks

(C:Contact hours, T:Training)

Syllabus:

1. The student must undergo hands on training in Apiculture during the internship programme at TNAU,CBE / training center.

2. The student must undergo field visit to ornamental fish farm and Poultry farm.
3. A report must be submitted by the student for hands on training in apiculture and field visit report on Ornamental fish farm and Poultry farm at the end of the VI semester.
4. Viva voce will be conducted by the internal Examiner.

External Assessment components

S.No	Report (35 Marks)		Viva Voce (40 Marks)		Total
1	Apiculture	25 Marks	Presentation	30 Marks	55
2	Ornamental Fishes	05 Marks	Response to questions and answers	10Marks	15
3	Poultry Farming	05 Marks			05
Total		35 Marks		40 Marks	75

B.Sc. ZOOLOGY SEMESTER IV

(For the students admitted during the academic year 2020-2021 only)

Course: Advanced Learners Course I – Wild life Management and Conservation	Course Code: 420ALZ
Semester: IV	No. of Credits: *4
CIA Max. Marks: -	ESE Max. Marks:100

Course Objectives:

- To study the habitat of wild life,
- To study the importance of management and conservation of wildlife
- To know the threats to wild life and Captive Breeding of Wild Animals
- To gain knowledge about wildlife legislation

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	explain the habitat of wild life, role of wet land in biodiversity conservation and management of wet land	U
CO2	describe the management and conservation of wildlife	U
CO3	discuss problems of wildlife management, Endangered and threatened species and current threats to biodiversity	U
CO4	discuss general behaviours and altruistic behaviours of wildlife.	U
CO5	describe animal population and explain Wildlife Tools and census techniques and explain the importance of Wildlife Legislation in wildlife conservation	U

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I:

1. Wildlife: Definition - Wildlife – Importance of wildlife - Depletion of Wildlife and its causes.
2. Wildlife Habitat: Forest types in India, Wetland habitat, Wetlands and their role in biodiversity conservation

3. Wetland management: structure, function, food chains, food webs, threats and conservation, Eco-restoration.
4. Management of Wildlife - Principles of Wildlife management - Management of Wildlife habitat.

Unit II :

1. Conservation and management of wildlife: Strategies in conservation,
2. Impact of forest fragmentation on wildlife.
3. In-situ conservation and Ex-situ conservation
4. Captive Breeding of Wild Animals: Management, problems and prospects; National parks, Sanctuaries, Biosphere Reserve, Community Reserves

Unit III:

1. Special Management Program of Wild Animals in India: Project Tiger, Operation Rhino and Project Elephant.
2. Problems of Wildlife management- Wildlife Trafficking, Poaching, Poisoning, Habitat destruction and Encroachment
3. Endangered and threatened species - Management of rare and endangered species, Control of weed species, Distribution, status, threats to survival of Elephant, Greater Adjutant stork, Rhino
4. Threats to wildlife: extinction, island biogeography, habitat destruction, fragmentation, exotic species and invasive, loss of biodiversity, Zoonotic disease- types and control.

Unit IV:

1. Wildlife Behaviour: Communications and Signalling
2. Territoriality, Home range and Scent marking
3. Courtship behaviour, Mating systems and Group living
4. Migration patterns; Predation behaviour; Selfishness and altruism and Optimal foraging theory

Unit V:

1. Importance of monitoring animal population and their habitats
2. Wildlife Tools, Techniques and Practices, Wildlife census techniques- direct and indirect methods, Modern census techniques used for rhino, tiger, migratory birds, GPS and GIS.
3. Wildlife Legislation: Wildlife Protection Act 1972, National Forest Policy 1988, National Wildlife Action Plan 2002, National and State Biodiversity Action Plans, Relevant Forest and Environmental Acts and amendments.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III, IV & V	Fundamentals of Wildlife Management	Rajesh Gopal	Nataraj Publication.

I,II, III, IV & V	Handbook of the Mammals of South Asia	Bahuguna & JMallik	Nataraj Publication
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Books for Reference:

Name of the Book	Authors	Publishers with Edition
Wildlife Biology: An Indian Perspective	Saha, G.K., and Majumdar	Prentice Hall of India

E-Resources: (Web resources & E-books)

<https://nptel.ac.in/courses/102/104/102104068/>

<https://nptel.ac.in/courses/102/104/102104068/>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy levels
CO1	H	M	-	M	H	U
CO2	H	M	-	M	H	U
CO3	H	M	-	M	H	U
CO4	H	M	-	M	H	U
CO5	H	M	-	M	H	U

Question Paper Pattern for ESC

Section A	(Open choice 5 out of 8 Questions) (5X20=100 marks)
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**B.SC. ZOOLOGY
SEMESTER VI**

(For the students admitted during the academic year 2020-2021 only)

Course: ADVANCED LEARNERS COURSE –II INSECT, VECTORS AND DISEASES	Course Code: 620ALZ
Semester: VI	No. of Credits: 4
CIA Max. Marks: -	ESE Max. Marks:100

(C:Contact hours, T:Tutorial)

Course Objectives:

- To gain knowledge about vectors and diseases.
- To create awareness about the disease causing vectors.
- To impart knowledge about the control of different insects and vectors.
- To understand the different types of infectious diseases.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	discuss the general features of insects and their feeding habits.	U
CO2	discuss carrier and vector, vectorial capacity, and their adaptations.	U
CO3	explain important dipteran vectors and their control	U
CO4	discuss important siphonaptera vectors and their control	U
CO5	discuss bugs as vectors and their control	U

R-Remembrance U –Understanding A-Apply**Syllabus:**

Unit I:

Introduction to Insects

General Features of Insects -morphological features, Head – eyes, types of antennae, mouth parts and feeding habit

Unit II:**Concept of Vectors**

Brief introduction of carrier and vectors (mechanical and biological vector), reservoirs, host-vector relationship, vectorial capacity, adaptations as vectors, host specificity.

Unit III:**Dipteran as Disease Vectors**

Dipterans as important insect vectors – mosquitoes, houseflies; study of mosquito-borne diseases – malaria, dengue, chikungunya, filariasis; control of mosquitoes. Study of house fly as important mechanical vector, myiasis, control of house fly

Unit IV:**Siphonaptera as Disease Vectors**

Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases –Plague, Typhus fever; Control of fleas Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases –Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse.

Unit V:**Hemiptera as Disease Vectors**

Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures

Books for Reference:

Name of the Book	Authors	Publishers with Edition
Manual of Zoology, Vol – I, Part I & II	Ekambaranatha Ayyar & T.N Ananthakrisnan	S.Viswanathan Pvt.Ltd . Chennai. (1992)
A General Text Book of Entomology.	Imms, A.D.	Chapman & Hall, UK, 1977
The Insects: Structure and Function	Chapman, R.F.	Cambridge University Press, UK IV Edition, 1998

E-Resources: (Web resources & E-books)

- <https://nptel.ac.in/courses/126104003/>
- https://www.who.int/water_sanitation_health/resources/vector007to28.pdf
- https://nptel.ac.in/courses/126104003/LectureNotes/Week-6_Paddy_IPM_lect3.pdf

Mapping of Course outcome with POs

CO	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	H	M	L	H	H	U
CO2	H	M	L	H	H	U

CO3	H	M	L	L	L	U
CO4	H	M	L	H	M	U
CO5	H	M	L	H	M	U

Question Paper Pattern for End Semester Examination

Section A	(Open choice 5 out of 8 Questions) (5X20=100 marks)
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**B.Sc. COURSES UNDER SKILL DEVELOPMENT COURSE
ZOOLOGY
SEMESTER IV**

(For the students admitted during the academic year 2020-2021 only)

Course: Part IV - Skill Enhancement Course II – Apiculture	Course Code: 420ZS2
Semester: IV	No. of Credits: 3
No. of hours : 45	C:T 39:6
CIA Max. Marks: 75	

(C:Contact hours, T:Tutorial)

Course Objectives:

- To gain knowledge about the types and life cycle of honey bee.
- To enable the students to learn the honeybee rearing technology.
- To instil knowledge about the honey extraction methods.
- To create awareness on self-employment opportunities.
- To get an idea about cottage industry.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	identify the different species and caste of honey bees with their life cycle.	U
CO2	understand the social life, selection of bees for apiculture with structure of hive and methods of bee keeping.	U
CO3	discuss the communication and memory of honeybees with collection of pollen and nectar from flowering plants, Inspection of bee hives, pesticidal poisoning by agriculture.	U
CO4	understand the seasonal management of honeybee colonies and transportation of bee hives, catching the swarm, natural enemies of honeybee and diseases of honeybee with their control.	U
CO5	discuss the chemical composition , nutritive and medicinal values of honey with equipment used for honey extraction.	U

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I:	(7 hrs)
Species of Honey bee and life cycle	
1. Types of honeybees: <i>Apis dorsata</i> (Rock bee) – <i>Apis indica</i> (Indian bee) – <i>Apis florea</i> (Little bee)- <i>Apis mellifera</i> (European bee).	
2. Polymorphism in honey bee: Morphology and development of honey bee	

3. Life cycle of Honeybee, functions of queen bee, worker bee and drone.

Unit II: (8 hrs)

Rearing techniques

1. Social life in honeybees.
2. Structure of Bee hive: Natural bee hive and Newtons hive
3. Selection of Bees for Apiculture.
4. Methods of bee keeping – Indigenous method – modern method.

Unit III: (8 hrs)

Functions of worker bee

1. Collection of Pollen from flowering plants.
2. Collection of nectar from flowering plants.
3. Inspection of bee hives.
4. Communication and memory of honeybees.
5. Pesticidal poisoning by agriculture.

Unit IV: (8 hrs)

Management of Honey bee

1. Seasonal management of honeybee colonies.
2. Catching the swarm.
3. Natural enemies of honeybee.
4. Diseases of honeybee and their control.
5. Transportation of bee hives

Unit V: (8 hrs)

Products of Apiculture

1. Honey
 - a. Equipments used for Honey Extraction
 - b. Chemical composition of honey
 - c. Nutritive and Medicinal values of honey
2. Bee wax and its uses
3. Royal jelly
4. Pollen
5. Propolis
6. Bee venom

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III, IV & V	The complete book on bee keeping and honey processing	NPCS Board of consultants and Engineers	Niir Project Consultancy Services, New Delhi

Books for Reference:

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III, IV & V	Economic Zoology	Dr.G.S.Shukla and Dr.V.B. Upadhyay	Rastogi publication, 4 th edition. (2003)
I,II, III, IV & V	Honey bee and their Management	S.B Withhead	Revised edition X (2010)

E-Resources: (Web resources & E-books)

- http://agritech.tnau.ac.in/farm_enterprises/fe_api_typesofhoneybee.html

- <https://en.wikipedia.org/wiki/Beehive>
- <http://www.fao.org/3/a-a0849e.pdf>
- <http://www.notesonzooology.com/india/apiculture/top-7-products-obtained-from-a-beehive-apiculture/155>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	H	H	M	L	L	U
CO2	H	H	H	L	L	U
CO3	H	H	H	L	L	U
CO4	H	H	M	L	L	U
CO5	H	H	H	L	L	U
CO 6	H	H	H	L	L	U

Internal Assessment components:

Components	CIA	Activity	Total
Marks	60	15	75

Question Paper Pattern

Section A	Open choice - 5 out of 8 Questions (5X4=20 marks)
Section B	Open choice - 5 out of 8 Questions (5X8=40 marks)

B.Sc. ZOOLOGY

SEMESTER V

(For the students admitted during the academic year 2020-2021 only)

Course: Part IV- Skill Enhancement Course III - ORNAMENTAL FISHES AND POULTRY FARMING	Course Code: 520ZS3
Semester: V	No. of Credits: 3
No. of hours : 45	C:T 39:6
CIA Max. Marks: 75	

(C:Contact hours, T:Tutorial)

Syllabus:

Unit I: Setting up of fish tank	(7 hrs)
1. Introduction – History of ornamental Fishes, Construction of fish tank, setting up of tank. 2. Accessories: Hood, light source, aerator, filters, light, nets, suction and tube scrapper tool. 3. Water quality management: Total Hardness, Temperature, pH, Dissolved Oxygen, Alkalinity and Ammonia 4. Ornamental plants.	

Unit II: Types of ornamental fishes and feed	(8 hrs)
1. Popular freshwater ornamental fishes a. Egg laying fishes – Siamese fighter fish, Gourami, gold fish, Barb, Tetras, Oscar, Cichlid and Angelfish. b. Live bearing fish – Molly, Guppy, Swordtail and Platy 2. Breeding methods of gold fish and angelfish. 3. Live feed organisms:	

- | | | |
|---------------------------------|-------------|---------------|
| a) Infusoria | (b) Daphnia | (c) Tubifex |
| d) Chironomous larva | (e) Artemia | (f) Spirulina |
| 4. Artificial feed preparation. | | |

Unit III: Ornamental fish Management	(8 hrs)
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| <ol style="list-style-type: none"> 1. Brood stock management 2. Types of Ornamental fish diseases and control. 3. Packing and transportation of live fishes. |
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Unit IV: Poultry Management	(8 hrs)
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| <ol style="list-style-type: none"> 1. Poultry industry in India: History and Breeds of fowls 2. Commercial layers and Broilers - Poultry housing. 3. The deep litter system, Cage rearing. 4. Management of layers and broilers - Summer and winter management of broilers – Debeaking |
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Unit V: Poultry Nutrition, Poultry Diseases and Vaccination	(8 hrs)
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1. Poultry nutrition

- a) Protein and Amino acids
- b) Vitamins
- c) Essential inorganic elements

2. Diseases

- Viral diseases: Ranikhet and Fowl pox
 Bacterial diseases: Fowl Cholera and Salmonellosis
 Fungal Diseases: Aspergillosis
 Animal parasite: Coccidiosis.

3. Vaccination - Vaccination programme.

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III,	Manual of Ornamental Fishes and Farming techniques	Jameson.J.D and Santhanam.R	Fisheries College, Tuticorin (1996)
IV & V	Modern aspects of Commercial Poultry keeping	Gnanamani.M.R.	Giri publications, Madurai. (2006)

Books for Reference:

Unit	Name of the Book	Authors	Publishers with Edition
I,II, III	Ornamental Fish Culture	Dr.V.K.Venkataramani	Fisheries College, Tuticorin (2007)
IV & V	Disease of Poultry	Bisres, H.E., and Schwarte	Oxford and IBH, UK (1989.)
	Poultry husbandry	Jull M.A	Tata McGraw Hill, Chennai (1972.)

Internal Assessment components:

Components	CIA	Activity	Total
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Marks	60	15	75
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Question Paper Pattern

Section A	Open choice - 5 out of 8 Questions (5X4=20 marks)
Section B	Open choice - 5 out of 8 Questions (5X8=40 marks)

**B.Sc. ZOOLOGY
SEMESTER V**

(For the students admitted during the academic year 2020-2021 only)

Course: PART III - CORE IX- GROUP PROJECT AND VIVA VOCE	Course Code: 520Z09
Semester: V	No. of Credits: 4
No. of hours : 60	-
CIA Max. Marks: 50	ESE Max. Marks:50

Instructions

- ✓ Students are allotted to faculties of the department according to their choice.
- ✓ Group size - five students.
- ✓ Subject viva voce will be conducted by internal and external examiners.

Syllabus:

Project will equip the students with basic knowledge in zoology and create interest in research. Group project will be done by the students in the topics related to zoology and project report must be submitted by the students at the end of sixth semester.

Internal and External Assessment components

S.No	Internal (50 Marks)		External (50 Marks)		Total
1	Report	25 Marks	Report	25 Marks	50
2	Viva voce	25 Marks	Viva voce	25 Marks	50
Total		50 Marks		50 Marks	100

**B.Sc. ZOOLOGY
SEMESTER V**

(For the students admitted during the academic year 2020-2021 only)

Course: PART III - CORE VIII -BIO STATISTICS, BIOINFORMATICS AND COMPUTER APPLICATIONS	Course Code: 520Z08
Semester: V	No. of Credits: 4
No. of hours : 75	C:T 65:10
CIA Max. Marks: 25	ESE Max. Marks:75

(C:Contact hours, T:Tutorial)

Course Objectives:

1. To study the fundamentals and applications of Biostatistics.
2. To gain knowledge about the collection of data.
3. To impart skill in calculations and construction of graphs and diagrams.
4. To realize its applications in research

5. To provide knowledge about computer, internet and to enhance computing skills.
6. To gain knowledge in basic principles and concepts of bioinformatics, protein, DNA data bases.

Course Outcomes: On completion of the Course the student will be able to

CO	Statement	Bloom's Taxonomy level
CO1	explain the process of data, classification, tabulation and organization.	U
CO 2	explain diagrammatical and graphical representation of data.	U
CO3	solve problems in mean, median and mode and also standard deviation and correlation	U
CO4	explain the software effectively to extract information from large databases and to develop information in the genomic study, phylogenetic analysis and sequence analysis.	U
CO5	discuss the common threats today in computer network	U

R-Remembrance U –Understanding A-Apply

Syllabus:

Unit I	(13 hrs)
1. Biostatistics – Applications. 2. Organization of statistical investigation. 3. *Collection of data- primary and secondary data and sources of primary and secondary data. 4. Methods of data collection – Census and sampling methods (Brief account). 5. Processing of data – Classification – tabulation - organization.	
Unit II	(13 hrs)
1. Diagrammatic representation – Bar diagrams, Pie diagrams. 2. *Graphic representation – Rules for constructing graphs – Graphs on time series 3. Range chart – Band graph 4. Graphs of frequency distribution – histogram – frequency polygon –smoothed frequency curve – O-give. 5. Graphic location of Median and Mode	
Unit III	(13 hrs)
Measures of Central tendency 1. Simple Arithmetic mean – Direct method only. 2. Median 3. Mode 4. Standard deviation, CV, Standard error. 5. Correlation – Definition and Types only 6. Karl Pearson's Co-efficient of correlation, types and use. 7. Chi-square test	
Unit IV	(13 Hrs)

1. Bioinformatics – Definition, Scope, Databases.
2. Bioinformatics tools and its uses- BLAST, RasMol,
3. Phylogenetic analysis- definition and applications, construction of phylogenetic tree- rooted and unrooted

Unit V (13 Hrs)

1. Definition of Computer – Basic components, input and output devices
2. CPU, Memory and its types.
3. Brief account on packages – MS Word & MS Excel.
4. Internet, Website and E-mail.

***Starred and underlined topics are for self study.**

Books for study:

Unit	Name of the Book	Authors	Publishers with Edition
I,II & III	Bio-Statistics	P. Ramakrishnan	Saras Publication, I Edition (2005).
I,II & III	Statistics for Biologists	S. Palanichamy	Paramount Publication, Palani, I Edition (1994)
IV	Bioinformatics for beginners	Dr.K. Mani and N. Vijayaraj	2003.

Books for Reference:

Name of the Book	Authors	Publishers with Edition
Statistical methods	S.P. Gupta	Sultan Chand & Sons, 10 th Edition (1989)
Bio-Statistics	Dr.P.N. Arora	Himalaya Publishing house, I Edition (1996)
Introduction to Bioinformatics	T.K. Attwood and D.J. Purry Smith	2004
MS office	Nellai kannan C.	NELS Publications, Tirunelveli.

E-Resources: (Web resources & E-books)

- https://onlinecourses.nptel.ac.in/noc18_bt21/preview
- <https://nptel.ac.in/courses/105101002/26>
- <https://nptel.ac.in/courses/102106065/>
- <https://nptel.ac.in/courses/106103068/17>

Mapping of Course outcome with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	Bloom's Taxonomy level
CO1	H	H	-	H	-	U
CO2	H	H	-	H	-	U
CO3	H	H	-	H	-	U
CO4	H	H	-	H	-	U
CO5	H	H	-	H	-	U

Internal Assessment components:

Components	CIA	Assignment	Objective type questions	Attendance	Total
Marks	15	4	4	2	25

Question Paper Pattern

Section A	MCQ – 10 Questions (10X1=10 marks)
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Section B	Either or Type - 5 Questions (5X4= 20 marks)
Section C	Either or Type - 5 Questions (5X9= 45 marks)