



**COURSE CURRICULUM FOR UNDERGRADUATE COURSES  
UNDER  
CHOICE BASED CREDIT SYSTEM**

**B.Sc. (Honours in Zoology)**

*With effect from 2015*

**VINOBA BHAVE UNIVERSITY  
HAZARIBAG 825319**

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## **Details of courses under B.Sc. (Honours)**

**Duration of study – 3 years**

**Total number of Semesters – VI**

**Total number of papers –**

**C - Honours/Core -14 theory, 6 Practical**

**GE - Generic Elective theory – 4 (1 each in Semester I to Semester IV)**

**GEP - Generic Elective Practical 4 (1 each in Semester I to Semester IV)**

**AECC – Ability Enhancement Compulsory Course 2(1 each in Semester I and Semester II)**

**SEC - Skill Enhancement Course – 2 (1 each in Semester III and Semester IV)**

**DSE - Discipline Specific Elective theory – 4 (2 each in Semester V and Semester VI)**

**DSEP - Discipline Specific Elective Practical – 2 (1 each in Semester V and Semester VI)**

- **Generic elective paper will be selected by the student and will continue from Semester I to Semester IV, i.e. student will continue the subject for two years in the form of four papers.**
  - **After completion of Degree course (H) it will be mentioned in the Degree that student has completed his/her Degree course in Zoology Hons with Botany/ Chemistry/ Physics as per the selection of Generic Elective paper.**
- **All the examinee (Hons.) have to complete 140 Credit in three years.**
- **A student can take up to 20 extra credits i.e. maximum credit 160 to enhance his /her study.**

**PROPOSED SYLLABI FOR CHOICE BASED CREDIT SYSTEM**  
**B.Sc. Honours in Zoology**

**SEMESTER-I**

<b>COURSE</b>	<b>Code Of Papers</b>	<b>Name of Papers</b>	<b>Credit</b>	<b>Full Marks</b>	<b>Pass Marks</b>
<b>CORE Course</b>	<b>C-1</b>	<b>Systematics and Diversity of Non chordate</b>	<b>04</b>	<b>75</b>	<b>40%</b>
	<b>C-2</b>	<b>Principle of Ecology</b>	<b>04</b>	<b>75</b>	<b>40%</b>
	<b>P-1</b>	<b>Practical based in C-1 and C-2</b>	<b>04</b>	<b>50</b>	<b>40%</b>
<b>AECC Ability Enhancement Compulsory Course</b>	<b>AECC-1</b>	<b>Communicative English /MIL</b>	<b>02</b>	<b>50</b>	<b>40%</b>
<b>Generic Elective</b>	<b>GE-1</b>	<b>Chemistry/ /Botany /Physics</b>	<b>04</b>	<b>75</b>	<b>40%</b>
		<b>Practical-GE</b>	<b>02</b>	<b>25</b>	<b>40%</b>
		<b>Total</b>	<b>20</b>	<b>350</b>	

**SEMESTER-II**

<b>COURSE</b>	<b>Code Of Papers</b>	<b>Name of Papers</b>	<b>Credit</b>	<b>Full Marks</b>			<b>Pass Marks</b>
				<b>Mid Sem</b>	<b>End Sem</b>	<b>Total</b>	
<b>Core Course</b>	<b>C 3</b>	<b>Cell Biology</b>	<b>4</b>	<b>15</b>	<b>60</b>	<b>75</b>	<b>40%</b>
	<b>C 4</b>	<b>Diversity of Chordates</b>	<b>4</b>	<b>15</b>	<b>60</b>	<b>75</b>	<b>40%</b>
	<b>P 2</b>	<b>Practical based on C-3 and C-4</b>	<b>4</b>	<b>10</b>	<b>40</b>	<b>50</b>	<b>40%</b>
	<b>AECC</b>	<b>Environmental Science</b>	<b>2</b>	<b>10</b>	<b>40</b>	<b>50</b>	<b>40%</b>
	<b>GE 2 T</b>	<b>Chemistry /Botany/Physics</b>	<b>4</b>	<b>15</b>	<b>60</b>	<b>75</b>	<b>40%</b>
	<b>GE 2 P</b>		<b>2</b>	<b>5</b>	<b>20</b>	<b>25</b>	<b>40%</b>
<b>TOTAL</b>			<b>20</b>			<b>350</b>	

### SEMESTER III

COURSE	Code Of Papers	Name of Papers	Credit	Full Marks			Pass Marks
				Mid Sem	End Sem	Total	
Core Course	C 5	Physiology	4	15	60	75	40%
	C 6	Biochemistry	4	15	60	75	40%
	C 7	Endocrinology	4	15	60	75	40%
	P 3	Practical based on C-5, C-6 and C-7	6	15	60	75	40%
Skill Enhancement Course	SEC 1	Aquarium Fish Keeping	2	10	40	50	40%
	GE 3 T	Chemistry /Botany/Physics	4	15	60	75	40%
	GE 3 P		2	5	20	25	40%
<b>TOTAL</b>			<b>26</b>			<b>450</b>	

### SEMESTER IV

COURSE	Code Of Papers	Name of Papers	Credit	Full Marks			Pass Marks
				Mid Sem	End Sem	Total	
Core Course	C 8	Genetics	4	15	60	75	40%
	C 9	Evolution	4	15	60	75	40%
	C 10	Animal Behaviour	4	15	60	75	40%
	P 4	Practical based on C-8, C-9 and C-10	6	15	60	75	40%
Skill Enhancement Course	SEC 2	Vermi-culture and Composting	2	10	40	50	40%
	GE 4 T	Chemistry /Botany/Physics	4	15	60	75	40%
	GE 4 P		2	5	20	25	40%
<b>TOTAL</b>			<b>26</b>			<b>450</b>	

### SEMESTER V

COURSE	Code Of Papers	Name of Papers	Credit	Full Marks			Pass Marks
				Mid Sem	End Sem	Total	
Core Course	C 11	Immunology	4	15	60	75	40%
	C 12	Developmental Biology	4	15	60	75	40%
	P 5	Practical based on C-11 and C-12	4	10	40	50	40%
Discipline specific Elective	DSC 1	Economic Zoology	4	10	40	50	40%
	DSE 2	Biostatistics	4	15	60	75	40%
	DSE 1 and 2 - P		4	15	60	75	40%
<b>TOTAL</b>			<b>24</b>			<b>400</b>	

### SEMESTER VI

COURSE	Code Of Papers	Name of Papers	Credit	Full Marks			Pass Marks
				Mid Sem	End Sem	Total	
Core Course	C 13	Molecular biology and Biotechnology	4	15	60	75	40%
	C 14	Medical Zoology	4	15	60	75	40%
	P 6	Practical based on C-13 and C-14	4	10	40	50	40%
Discipline specific Elective	DSC 3	Wild Life conservation and Management	4	10	40	50	40%
	DSE 4	Agrochemical and Pest management	4	15	60	75	40%
	DSE 3 and 4 - P	Practical based on DSE-3 and DSE-4	4	15	60	75	40%
<b>TOTAL</b>			<b>24</b>			<b>400</b>	

# **B.Sc. (Hons.) Zoology**

## **Semester I Core Course C-1**

In all **EIGHT** questions are to be set of equal value, out of which students would be required to answer **FOUR** questions.

**Question number 1 (One) will be compulsory and consists of objective type / multiple choice / very short answer type.**

**Question number Two, Three and Four will be of short answer type** covering the whole syllabus.

**Question number Five, Six, Seven and Eight will be of long answer type**

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**Systematics and Diversity of Non Chordate (Credit 4) Hours of teaching =60      FM 60**

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### **UNIT-1      Systematics**

- 1.1 Binomial & Trinomial nomenclature,
- 1.2 New trends in animal Taxonomy (Chemotaxonomy, Cyto-taxonomy & Molecular Taxonomy)
- 1.3 Species and Speciation
- 1.4 Linnaean hierarchy

### **UNIT-2      Non-Chordates: Characters & Classification**

General characters and classification of different phyla of Non Chordates up to classes with examples showing distinctive / adaptive features

### **UNIT-3 Non Chordate: Protista to Pseudocoelomates**

- 3.1 Phylum Protozoa:**      General account of locomotion, Nutrition and reproduction
- 3.2 Phylum Porifera**      Canal system in Porifera
- 3.3 Phylum Coelenterate**      Obelia Life cycle and metagenesis, Polymorphisms in Siphonophora, Coral Reefs –types, formation and distribution
- 3.4 Platyhelminthes:**      **Planaria (General organization)**

### **UNIT-4 Non Chordate: Coelomates**

- 4.1 Annelida:** Segmental organs (Coelomo-ducts & meta-nephridia) in annelid
- 4.2 Arthropoda:**      Larval form of Crustacea
- 4.3 Mollusca:**      Torsion and Detorsion in Gastropods
- 4.4 Echinoderm:**      Water vascular System and locomotion in Asterias, Larval forms of echinoderms.

## **Books Recommended**

### **Systematics (Animal Taxonomy)**

1. Dalela and Sharma: Animal Taxonomy and Museology (1976, Jai Prakash Nath).
2. Kapoor: Theory and Practicals of Animal Taxonomy (1988, Oxford & IBH).
3. Simpson: Principles of Animal Taxonomy (1962, Oxford).
4. Roymahoney: Laboratory Techniques in Zoology (1966, Butterworths).
5. Mayer and Ashlock: Principles of Systematic Zoology (1991, McGraw Hill).

### **Non Chordates**

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
4. Boolotian and Stiles: College Zoology (10<sup>th</sup> ed 1981, Macmillan)
5. Campbell and Reece: Biology (7<sup>th</sup> edn. 2005, Pearson)
6. Miller and Harley: Zoology (6<sup>th</sup> ed. 2005, W.C. Brown)
7. Nigam: Biology of Non-chordates (1997, S Chand)
8. Parker and Haswell: Text Book of Zoology, Vol. I (2005, Macmillan)

## Semester -1 Core Course (C-2)

In all **EIGHT** questions are to be set of equal value, out of which students would be required to answer **FOUR** questions.

**Question number 1 (One) will be compulsory and consists of objective type / multiple choice / very short answer / type.**

**Question number Two, Three and Four will be of short answer type** covering the whole syllabus.

**Question number Five, Six, Seven and Eight will be of long answer type**

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**Principle of Ecology (Credit 4)**

**Hours of teaching 4X15 = 60 hrs**

**FM 60**

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### **UNIT- 1. General concepts**

- 1.1 Introduction to environmental biology
- 1.2 Components of ecosystem
- 1.3 Major ecosystems in world
- 1.4 Energy flow in ecosystem
- 1.5 Productivity, food chain and food web, Food Pyramid
- 1.6 Bio- Geochemical cycle
  - 1.6.1 Water Cycle
  - 1.6.2 Gaseous Cycles- Carbon and Nitrogen
  - 1.6.3 Sedimentary Cycle- Phosphorous and sulphur

### **UNIT - 2. Population and communities**

- 2.1 Population characteristics: Density, Natality, Mortality, Age pyramid and Growth curve
- 2.2 Nature, Structure and attributes of biological communities.
- 2.3 Ecological succession and concept of climax

### **UNIT- 3. Pollution**

- 3.1 Sources and impact of environmental pollutants- air, water, soil and Noise
- 3.2 Global environmental changes-
  - a) Greenhouse gases and their effects
  - b) Acid rains
  - c)

### **UNIT- 4. Natural resources**

- 4.1 Soil, water, mineral resources and their conservation.
- 4.2 Biodiversity- benefits, hotspots, threats and conservation.
- 4.3 Human impact on mineral resources.
- 4.4 Renewable and Non Renewable Source of Energy.



## **Books Recommended**

1. Colinvaux, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
2. Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
3. Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
4. Robert Leo Smith Ecology and field biology Harper and Row publisher
5. Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Press
6. Ecology Environment and Resource conservation: J S Singh, S P Singh and S R Gupta, Anamaya Publishers, New Delhi
7. Ecology Concept and application: Manuel C Molles Jr, Mc Graw Hill
8. Living in the environment: G Tyler Miller, Thompson

## P-1 Practical Based on C-1 and C-2

### Systematics and Diversity of Non Chordate and Principle of Ecology

Credit 4    Hours of teaching    4X15 = 60 hrs    FM 50 (40 External + 10 Internal)

Dissection:	08
Mounting:	04
Spotting:	2 x 5 = 10
Ecological experiment:	08
Sessional work:	05
Vivavoce:	05

#### Part A:        Systematics and Diversity of Non Chordates

##### 1. Study of Available Museum Specimens of animals

- *Sycon* (As an example of parazoa), *Hydra* (as an example of diplo-blastic animal), *Fasciola* (as an example of triplo-blastic acoelomate animal), *Ascaris* (as an example of triplo-blastic pseudo-coelomate animal), *Hirudinaria* (as an example of triploblastic schizocoelomate animal), Hermit Crab, Scorpion, Unio, *Sepia*, *Aplysia*, *Loligo*, Sea Urchin, *Ophiothrix* (Brittle star) ( Example of Triplo-blastic coelomate)

##### 2. Study of the following through permanent slides

1. Paramecium Slide (WM)
2. Gemmules of sponges
3. Conjugation in *Paramecium*,
4. Sporocyst of *Fasciola* with developing Redia, Cercaria and Metacercaria larvae
5. Nauplius Metanauplius, Cypris, Megalopa and Zoea larvae of Crustacea
6. Bipinnaria

##### 3. Dissection:

1. Dissection of Digestive and nervous system of Earthworm
2. Dissection of digestive system of *Palaemon* and Nervous system of *Palaemon*
3. Dissection of Nervous system of *Pila*

##### 4. Mounting

Mounting of Nephridia & ovary of earth worm, statocyst of *Palaemon*, heart, trachea and salivary gland of *Periplaneta americana*, Radula of *Pila*, Cephalic appendages of *Palaemon*

#### B. Ecology

1. Collection and Identification of different biotic component of pond Ecosystem
2. Estimation of dissolved oxygen.
3. Estimation of carbon dioxide
4. Estimation of Total alkalinity

## B.Sc. (Hons.) Zoology Semester II

In all **EIGHT** questions are to be set of equal value, out of which students would be required to answer **FOUR** questions.

**Question number 1 (One) will be compulsory and consists of objective type / multiple choice / very short answer / type.**

**Question number Two, Three and Four will be of short answer type** covering the whole syllabus.

**Question number Five, Six, Seven and Eight will be of long answer type**

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<b>C-3</b>	<b>Cell Biology</b>	<b>Credit - 4</b>	<b>Hours of teaching 4X15=60</b>	<b>FM 60</b>
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### Cell Biology

#### UNIT-1. The Cell and its Organization

- 1.1 Introduction to cell theory
- 1.2 Comparison of a generalized pro- and eukaryotic cell
- 1.3 Methods in cell biology: Elementary idea of microscopy (Light and Electron Microscope) and cell fractionation.
- 1.4 Structure and function of plasma membrane and cell junctions
- 1.5 Introduction to endo-membrane system (Endoplasmic reticulum, Golgi complex, Lysosome)
- 1.6 Structure and functions of cytoskeleton
- 1.7 Structure and function of mitochondria

#### UNIT-2.Nucleus

- 2.1 Nuclear envelope
- 2.2 Chromosome: Structure & function
- 2.3 Introduction to polytene and lampbrush chromosomes

#### UNIT - 3. Cell Division

- 3.1 Basic feature of Cell cycle
- 3.2 Mitosis & Meiosis and their significance
- 3.3 Elementary idea of cancer

#### UNIT-4. Elementary idea of Apoptosis and Necrosis

## **B.Sc. (Hons.) Zoology Semester II**

In all **EIGHT** questions are to be set of equal value, out of which students would be required to answer **FOUR** questions.

**Question number 1 (One)** will be compulsory and consists of objective type / multiple choice / very short answer / type.

**Question number Two, Three and Four** will be of short answer type covering the whole syllabus.

**Question number Five, Six, Seven and Eight** will be of long answer type

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**C-4 Diversity of Chordates Credit -4 Hours of teaching: 4X15=60hrs FM 60**

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### **UNIT-1. Protochordates**

- 1.1 Character and affinities of Amphioxus
- 1.2 Retrogressive metamorphosis in Herdmania

### **UNIT-2 Chordates: General characters and classification of the following up to sub classes with examples**

- 2.1 Cyclostomes
- 2.2 Fishes
- 2.3 Amphibians
- 2.4 Reptiles
- 2.5 Birds
- 2.6 Mammals

### **UNIT- 3. Cyclostome, Fish & Amphibians**

- 3.1 Comparative account of Petromyzon and Myxine
- 3.2 Accessory Respiratory organ in fishes
- 3.3 Pedogenesis and neoteny with special reference to Axolotl larvae
- 3.4 Origin and evolution of Amphibia

### **UNIT-4. Reptiles, Birds & Mammals**

- 4.1 Poisonous and Non-poisonous Snakes of India, Poison's Apparatus and mechanism of biting.
- 4.2 Flight Adaptation and mechanisms of flight
- 4.3 Structure and Affinities of Prototheria and Metatheria
- 4.4 Comparative anatomy of Heart, Integument, Aortic Arches and Kidney in vertebrates

## **Books Recommended**

### **Cell Biology**

1. Alberts *et al*: Essential Cell Biology (1998, Garland)
2. Karp: Cell and Molecular Biology (2008, John Wiley)
3. Lodish *et al*: Molecular Cell Biology (2008, Freeman) 2004
4. Pollard & Earnshaw: Cell Biology (2002, Saunders)
5. Cooper and Hausman: The Cell A Molecular approach (2007, Sinauer)

### **Chordate**

- 6 Miller and Harley: Zoology (6th ed. 2005, W.C. Brown)
- 7 Nigam: Biology of Chordates (1997, S Chand)
- 8 Parker and Haswell: Text Book of Zoology, Vol. II (2005, Macmillan)
- 9 Purves et al: Life-the Science of Biology, (7<sup>th</sup> ed. 2004, Sinauer)
- 10 Romer, A. S. and Parsons, T. S., The vertebrate body, 6th edition, CBS Publishing Japan Ltd, 1986.
- 11 Sinha, A. K., Adhikari, S. and Ganguli, B. B.: Biology of Animals, Vol. II, New Central Book Agency, Calcutta, 1988.
- 12 Young, J. Z. The life of vertebrates, 3rd edition, ELBS with Oxford University Press, 1981.
- 13 Vishwanath, Vertebrate Zoology

## B.Sc. (Hons.) Zoology Semester II

P-2 Practical based on C-3 and C-4 Credit-4 Working hours -60

FM 50 (40 External + 10 Internal)

<b>Dissection:</b>	<b>08</b>
<b>Mounting:</b>	<b>04</b>
<b>Spotting:</b>	<b>2 x 5 = 10 (2 Specimen, 2 Bones, 1 Slide)</b>
<b>Preparation of cytological slide:</b>	<b>08</b>
<b>Sessional work:</b>	<b>05</b>
<b>Vivavoce:</b>	<b>05</b>

1. Study of slides of prokaryotic cell-Bacteria
2. Study of slides of Unicellular Eukaryotic cell –*Amoeba, Paramecium*
3. Study of various stages of cell division through permanent slides Mitosis and Meiosis
4. Preparation of mitotic slides from onion root tips.
5. Study of Blood cells through slide preparation
6. Study of Barr body through slide preparation from hair follicle /cheek cells of female.

### Chordate Diversity

7. Pisces: Rohu, *Exocoetus, Hippocampus, Torpedo* ( Electric Ray)
8. Amphibia: *Hyla, Alytes, Salamander*
9. Reptiles: *Draco, Hydrophis, Bungara, Pit Viper, Naja, Python*
10. Aves :Ostrich model
11. Prototheria Models of Duck bill platypus, Spiny ant eater
12. Bones of Amphibia and Mammal
13. Study of histological slides of mammal: Skin, Bone, Lung, Stomach, Intestine, Liver, Kidney.
14. Dissection of local bony fishes ; Afferent and efferent and nervous system
15. Mounting of Scale
16. Mounting of rectrices

## **B.Sc. (Hons.) Zoology Semester III**

In all **EIGHT** questions are to be set of equal value, out of which students would be required to answer **FOUR** questions.

**Question number 1 (One) will be compulsory and consists of objective type / multiple choice / very short answer / type.**

**Question number Two, Three and Four will be of short answer type** covering the whole syllabus.

**Question number Five, Six, Seven and Eight will be of long answer type**

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**C-5: Mammalian Physiology    Credit-4    Hours of teaching 4X15=60    FM 60**

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### **UNIT\_1. Nutrition and Digestion**

- 1.1 Balanced diet
- 1.2 Digestion and absorption of carbohydrates, proteins and fats

### **UNIT-2. Respiration and Circulation**

- 2.1 Mechanism and regulation of breathing
- 2.2 Transport of oxygen and carbon dioxide
- 2.3 Respiratory quotient
- 2.4 O<sub>2</sub> and CO<sub>2</sub> dissociation curve, Bohr and Haldane effect, chloride shift
- 2.5 Composition of blood and lymph
- 2.6 Blood groups and Blood clotting
- 2.7 Cardiac cycle and its regulation

### **UNIT3. Renal and Reproductive Physiology**

- 3.1 Structure and types of Nephron.
- 3.2 Urine formation.
- 3.3 Hormonal control of renal function.
- 3.4 Osmo-regulators and osmo-conformers.
- 3.5 Anatomy of Human reproductive organs.
- 3.6 Histological details of testes and functions
- 3.7 Histological details of ovary and functions
- 3.8 Menstrual Cycle in Humans

### **UNIT-4. Nerve physiology**

- 4.1 Myelinated and non- myelinated nerve fibers
- 4.2 Resting and action potential
- 4.3 Initiation and conduction of nerve impulse through myelinated nerve
- 4.4 Synapse and Synaptic Transmission

## **B.Sc. (Hons.) Zoology Semester III**

In all **EIGHT** questions are to be set of equal value, out of which students would be required to answer **FOUR** questions.

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**C-6 BIOCHEMISTRY**

**Credit 4(T)**

**Teaching Hrs. 60**

**FM 60**

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### **UNIT-1. Biomolecules**

- 1.1 **Amino acids:** Properties, Structure and classification
- 1.2 **Proteins:** Classification, Structural organisation and conformation
- 1.3 **Carbohydrates:** Structure, Classification and biological significance
- 1.4 **Lipids:** Structure, Classification and biological significance

### **UNIT-2. Enzymes**

- 2.1. General properties
- 2.2. Major classes of enzymes
- 2.3. Mechanism of enzyme action

### **UNIT-3. Nucleic acids**

- 3.1. DNA structure: DNA double helix (Watson and Crick model)
- 3.2. Types of RNA

### **UNIT-4. Metabolic path way**

- 4.1 Glycolysis
- 4.2 Krebs cycle
- 4.3 Beta oxidation



## **B.Sc. (Hons.) Zoology Semester III**

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**Question number Two, Three and Four** will be of short answer type covering the whole syllabus.

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**C-6 Endocrinology**

**Credit 4(T)**

**Teaching: 60**

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### **UNIT-1. Classification of chemical messengers**

- 1.1 Hormones and their classification
- 1.2 Neurohormones and neurotransmitters
- 1.3 Pheromones
- 1.4. General mechanism of hormone action

### **UNIT -2 Structures and functions of endocrine organs**

- 2.1 Pituitary
- 2.2 Thyroid
- 2.2 Adrenal
- 2.3 Endocrine pancreas
- 2.4 Pineal

### **UNIT-3. Gastrointestinal hormones (gastrin, CCK, secretin and motilin)**

### **UNIT-4. Hormones, Drugs and Human health- production of hormones as pharmaceuticals Growth hormone and Insulin.**

## **Suggested Reading**

### **Mammalian Physiology**

1. Nielson: Animal Physiology – Adaptation and Environment (5th ed. 2008, Cambridge)
2. Marshall and Hughes: Physiology of Mammals and Vertebrates (2nd ed. 1980, Cambridge)
3. Hoar: General and Comparative Physiology (3rd ed., 1987, Prentice Hall)
4. Prosser: Comparative Animal Physiology (4th ed. 1991, Satish Book)
5. C.C.Chaterjee Medical physiology
6. Guyton– A Text Book of Medical Physiology

### **Biochemistry**

1. Boyer: Concepts in Biochemistry (3rd ed. 2006, Brooks/Cole)
2. Lehninger, Nelson & Cox: Principles of Biochemistry (4th ed, 2007, Worth),
3. Murray *et al*: Harper's Biochemistry (25th ed. 2000, Appleton & Lange)
4. Stryer: Biochemistry (5th ed. 2001, Freeman)
5. Conn, Stumpf, Bruening & Doi: Principles of Biochemistry (5th ed. 1987, Wiley)
6. Harper's Illustrated Biochemistry

### **Endocrinology**

1. Hadley: Endocrinology (5th ed. 2000, Prentice Hall)
2. Turner and Bagnara: General Endocrinology, 6th ed.1984, Saunders)
3. Williams and Williams: A Text Book of Endocrinology
4. Nooris: Vertebrate Endocrinology



## **B.Sc. (Hons.) Zoology Semester III**

In all **EIGHT** questions are to be set of equal value, out of which students would be required to answer **FOUR** questions.

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**SEC -1 Aquarium fish keeping**

**Credit-2**

**Teaching hrs. 30**

**FM 50**

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### **AQUARIUM FISH KEEPING (CREDITS 2)**

**Unit 1:** The potential scope of aquarium fish industry as a Cottage Industry. Exotic and Endemic species of Aquarium fishes

**Unit 2:** Common Characters and sexual dimorphism of fresh water and marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold Fish, Angel fish, Blue morph, Anemone fish and butterfly fish.

**Unit 3:** Food and feeding of Aquarium fishes- Use of live fish feed organisms. Preparation and composition of formulated fish seeds.

**Unit 4:** Live fish transport- Fish handling, packing and transport techniques

**Unit 5:** General Aquarium maintenance- budget for setting up an aquarium fish farm as a cottage industry, Common disease of aquarium fishes and their treatment

## Books Recommended

1. A Complete Guide to Aquarium Keeping Paperback – A. Biju Kumar, Marishanker Alappat
2. Aquarium Care of *Bettas* (Animal Planet Pet Care Library) Hardcover - David E. Boruchowitz, Hardcover
3. Ornamental Fish Culture and Aquarium Management Hardcover – 2009, by A D Kholakia Hardcover
4. Pet Manual: Discus Fish (Complete Pet Owner's Manual) Paperback – by Thomas Giovanetti, Oliver Lucanus Paperback
5. Aquarium Plants: Comprehensive Coverage, From Growing Them To Perfection To Choosing The Best Varieties (Mini Encyclopedia Series for Aquarium Hobbyists) Paperback by Peter Hiscock, Paperback

## **B.Sc. (Hons.) Zoology Semester IV**

In all **EIGHT** questions are to be set of equal value, out of which students would be required to answer **FOUR** questions.

**Question number 1 (One)** will be compulsory and consists of objective type / multiple choice / very short answer / type.

**Question number Two, Three and Four** will be of short answer type covering the whole syllabus.

**Question number Five, Six, Seven and Eight** will be of long answer type

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**C-8 Genetics**

**Credit-4**

**Hours of teaching 4X15=60**

**FM 60**

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### **Genetics**

#### **UNIT-1. Elements of heredity and variation**

1.1 Mendel and his experiments

1.2 Principles of segregation and independent assortment and their chromosomal basis

#### **UNIT-2. Extension of Mendelism**

2.1 Dominance relationships (Complete dominance incomplete dominance and co-dominance)

2.2 Multiple allelism

2.3 Lethal alleles

2.4 Pleiotropy

2.5 Epistasis

2.6 Polygenic inheritance

2.7 Cytoplasmic inheritance

**2.8** Linkage and crossing over

2.9 Sex- linkage

#### **UNIT-3 Sex Determination**

**3.1** sex chromosomes systems and sex determination: XX/XO, XX/XY, ZZ/ZW and haploidy/ diploidy types

3.2 dosage compensation

3.3 Sex limited and sex influenced traits

#### **UNIT-4. Mutation**

4.1 Structural and numerical alterations of chromosomes and related disorder

4.2 Single gene disorder

4.3 Genetic counselling

## **B.Sc. (Hons.) Zoology Semester IV**

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**C-9 Evolution**

**Credit-4**

**Hours of teaching 4X15=60**

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### **UNIT-1 History and Evidence of Evolution**

- 1.1. Geological Time Scale and Geological Era
- 1.2. Zoogeographical regions and Animal Distribution
- 1.3. Fossil as direct evidence
- 1.4. Types of Fossil
- 1.5. Dating of fossil
- 1.6. Phylogeny of Horse
- 1.7. Chronological order of fossils of man

### **UNIT -2 Introduction to source of evolution & evolutionary Theories**

- 2.1 Lamarckism
- 2.2 Darwinism
- 2.3 Neo Darwinism
- 2.4. Source of Variation: Mutation & Recombination
- 2.5 Sexual Isolation
- 2.6 Natural Selection in action (Industrial melanism)

### **UNIT-3 .Hardy Weinberg law of Equilibrium**

- 3.1 Principle and attributes
- 3.2 Genetic Drift
- 3.3 Founder effect
- 3.4 Bottle Neck Effect

### **UNIT-4 Level of Evolution**

- 4.1** Micro- evolution
- 4.2 Macro-evolution
- 4.3 Mega- Evolution

## **B.Sc. (Hons.) Zoology Semester IV**

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<b>C-10</b>	<b>Animal Behaviour</b>	<b>Credit-4</b>	<b>Hours of teaching 4X15=60</b>
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### **UNIT-1. Concepts and pattern of Behaviour**

- 1.1 Innate /Instinct Behaviour
- 1.2 Acquired/ learned behavior

### **UNIT-2. Control of Behaviour**

- 4.1 Neural control
- 4.2 hormonal control

### **UNIT-3 Social organization**

- 3.1 Social organization in honey bee and Termites
- 3.2 Communication in animals

### **UNIT-4 Miscellaneous topics**

- 4.1 Migration in Fishes and Birds
- 4.2. Biological Rhythms
- 4.3 Parental Care in fishes and Amphibian
- 4.4 Deep sea adaptation



## P-4 Practical based on C-8, C-9 & C-10

### FM 75 (External 60 + Internal 15)

Credits 2+2+2=6

Total Practical hours -90

Verification of law of segregation	10
Identification and comment on given fossil	10
Pedigree analysis	10
Study of Bee hive / Termite Mound	05
To study geotaxis behaviour in earthworm	05
Viva voce	10
Sessional record	10

#### Genetics

1. Experimental verification of principles of segregation and independent assortment using coloured beads and chi-square test.
2. Study of pattern of inheritance in human population of the traits Rolling of tongue and Mid digital hair, hypertrichosis, widow's peak.
3. Study of mutants in *Drosophila*
4. Genotype analysis in the pedigree chart of the Victorian family affected with haemophilia
5. Study of Colour blind by Ishiharachart

#### Evolution

1. Genotypic analysis of Taster and Non Taster for PTC in human population to estimate allele frequencies by Hardy -Weinberg equation
2. Fossils study: Trilobites,
3. Models of Chordate fossils – *Brontosaurus*, *Dimetrodon*, *Archaeopteryx*, *Dinoceras*.
4. Evolution of Horse – through models
5. Study of Serial homology exhibited by teeth and appendages
6. Study of Homologus and Analogus organ

#### Animal Behaviour

1. Study of geo-taxis, photo -taxis, hygro- taxis in animals
2. Locomotory behaviour of dipteran larvae (Housefly/blowfly/fruitfly):
3. Locomotion on different types of substrata (writing paper, plastic sheet and sand paper)
5. Study of individual and behavioural patterns of dog
5. Study of inter-specific association
6. Study of bee hive and mound of termites

## **Recommended Books**

### **Genetics**

1. Brooker: Genetics: Analysis and Principles (1999, Addison-Wesley,)
2. Gardner *et al*: Principles of Genetics (1991, John Wiley)
3. Griffith *et al*: An Introduction to Genetic Analysis (2005, Freeman)
4. Hartl and Jones: Essential Genetics: A Genomic Perspective (2002, Jones & Bartlett)
5. Russell: Genetics (2002, Benjamin Cummings)
6. Snustad and Simmons: Principles of Genetics (2006, John Wiley)
7. Lewin: Genes IX (2008, Jones & Bartlett)

### **Evolution**

1. Moody: Introduction to Evolution (1978, Kalyani).
2. Savage: Evolution (1963, Holt, Reinhart and Winston)
3. Rastogi: Organic Evolution (1988, Kedarnath and Ramnath)
4. Strickberger: Evolution (2004, Jones & Bartlett)

### **Animal Behaviour**

1. Drickamer and Vessey : Animal Behaviour – concepts, processes and methods (2nd ed. 1986, Wadsworth)
2. Freeland: Problems in Practical Advanced Level Biology (1985, Hodder & Stoughton,)
3. Goodenough et al.: Perspectives on Animal Behaviour (1993, Wiley)
4. Grier: Biology of Animal Behaviour (1984, Mosby)
5. Lorenz: The Foundation of Ethology (1981, Springer)
6. Manning & Dawkins: An Introduction to Animal Behaviour (5th ed. 1998, Cambridge).
7. Mcfarland : Animal Behaviour, Psychology, Ethology and Evolution (1985, Pitman).
8. Slater: An Introduction to Ethology (1985, Cambridge).

## **B.Sc. (Hons.) Zoology Semester IV**

In all **EIGHT** questions are to be set of equal value, out of which students would be required to answer **FOUR** questions.

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**SEC-2 Vermi-culture and composting**

**Credit-2**

**Hours of teaching 30**

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### **SKILL ENHANCEMENT COURSE**

**UNIT-I:** General properties of the soil - structure of the soil -sand, clay, salt, types of soils - soil organisms.

**UNIT-II:** Physical properties of soil - soil colour, soil moisture, soil temperature, bulk density of soil, chemical properties of soil PH, Electrical conductivity, organic, Nitrogen, Phosphate and potash.

**UNIT-III:** Composting -anaerobic composing, aerobic composing, types of composing, vermi-compost- earthworm species used in vermi-compost production - endemic species, exotic species.

**UNIT-V:** Vermicomposting -setting up vermicompost quality N, P, K, C, N, Microbial quality applications —vermiculture - vermiwash —role of vermicompost in organic farming - its quality and advantages over chemical inputs. Earthworms in Bio-reclamation of soil. Problems in vermiculture units - remedial suggestions. Vermicomposting as a tool for solid waste management - a small scale industry and it's economics.

### **Recommended Books**

1. Brady, C.N, 1974 "The Nature and Properties of soils" Macmillan publishing Co. New York, London.
2. Edwards, C.A., and Bohlen, P.J., 1996. Biology and Ecology of Earthworms, Chapman and Hall, London Ismail, S.A., 1997, Vermicology: The Biology Earth worm Orient Longman
3. Kale Radha,D 1998. Earthworm: Cinderella of organic farming. Prism Books Pvt. Ltd., Bangalore.
4. Satchell,J.E., 1983 Earthworm ecology: From Darwin to Agriculture. Chapman and Hall, London Stephenson J., 1923. The fauna of British India -Oligo

Dr D N Sadhu  
DR Ajay K Sharma

Dr N Alam  
Dr K K Gupta

Dr B K Gupta  
Dr Anjana Verma

## **B.Sc. (Hons.) Zoology Semester V**

In all **EIGHT** questions are to be set of equal value, out of which students would be required to answer **FOUR** questions.

**Question number 1 (One) will be compulsory and consists of objective type / multiple choice / very short answer / type.**

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<b>C-11</b>	<b>Immunology</b>	<b>Credit-4</b>	<b>Hours of teaching 4X15=60</b>	<b>FM 60</b>
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### **Immunology**

#### **UNIT-1 . Introduction to Immunity**

#### **UNIT-2. Cell and organs of immune system**

- 2.1 Types of immune cells, lymphoid and myeloid
- 2.2 Primary and secondary lymphoid organs and lymphatic system

#### **UNIT-3. Humoral immunity**

- 3.1 Antigen
- 3.2 Immunoglobulins: types, structure and function
- 3.3 Generation and diversity of antibodies
- 3.4 Function of B cell
- 3.4 Complement System

#### **UNIT-4. Cell mediated immunity**

- 4.1 Structural organization of MHC complex
- 4.2 Antigen processing and presentation
- 4.3 Function of T-Cells
- 4.4 Monoclonal Antibody
- 4.5 ELISA

## **B.Sc. (Hons.) Zoology Semester V**

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**C-12    Developmental Biology    Credit-4    Hours of teaching 4X15=60    FM 60**

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### **UNIT-1 Early embryonic development**

- 1.1 Spermatogenesis
- 1.2 Oogenesis
- 1.3 Ultra structure of sperm and ovum
- 1.4 Pre fertilization Events: Attraction of gametes, Fertilizin –Antifertilizin Interaction, capacitation, Acrosomal Reaction , Amphimixis
- 1.5 Post fertilization events: Prevention of Polyspermy , Cortical reaction
- 1.6 Types of cleavage
- 1.7 Role of yolk in cleavage
- 1.8 construction of fate map

### **UNIT\_2 Late embryonic Development**

- 2.1. Extra embryonic membranes in chick
- 2.2 Placenta: Structure, Type and function

### **UNIT-3, Post Embryonic Development**

- 3.1 Metamorphosis in Insect
- 3.3 Regeneration
- 3.5 Concepts of Ageing

### **UNIT-4 Embryo transfer technology**

- 4.1. Principles of collections of Umbilical cord, gametes and embryos
- 4.2 Cryopreservation of gametes
- 4.3. Superovulation and embryo transfer technology
- 4.4 Teratogen and their effects on embryonic development, Amniocentesis

## **P-5 Practical based on C-11 and C-12**

### **FM 75 (External 60 + Internal 15)**

**Credits 2+2=**

**Total Practical hours - 60**

<b>1</b>	<b>Preparation/Study of chick embryo slide</b>		<b>05</b>
<b>2</b>	<b>Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages)</b>	<b>5 marks x 2</b>	<b>10</b>
<b>3</b>	<b>Preparation of stained blood film to study various types of blood cells</b>		<b>10</b>
<b>4</b>	<b>Histological study of spleen, thymus and lymph nodes through slides/photographs</b>	<b>2.5x2</b>	<b>05</b>
<b>5</b>	<b>Study of different sections of placenta (photomicrograph/ slides)</b>		<b>10</b>
<b>6</b>	<b>Viva voce</b>		<b>10</b>
<b>7</b>	<b>Sessional record</b>		<b>10</b>

### **Recommended Books**

#### **Developmental Biology**

1. Alberts *et al*: Molecular Biology of the Cell (2008, Garland)
2. Balinsky: An Introduction to Embryology (1981, CBS)
3. Gilbert: Developmental Biology (8<sup>th</sup> ed., 2006, Sinauer)
4. Wolpert: Principles of Development (3<sup>rd</sup> ed. 2007, Oxford)

#### **Immunology**

1. Abbas *et al*: Cellular and Molecular Immunology (2001, Saunders)
2. Alberts *et al*: Molecular Biology of the Cell (5<sup>th</sup> ed. 2008, Garland)
3. Kuby Immunology (2003, Freeman)
4. Roitt and Delvis: Roitt's Essential Immunology (6<sup>th</sup> ed. 2006, Blackwell)

## B.Sc. (Hons.) Zoology Semester V

In all **EIGHT** questions are to be set of equal value, out of which students would be required to answer **FOUR** questions.

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DSE-1

Economic Zoology

Credit-4

Teaching Hrs -60

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### Unit 1: Bee-keeping and Bee Economy (Apiculture)

Varieties of honey bees, stingless honey bee and Bee pasturage; Setting up an apiary. Rearing equipment, handling of bees, artificial diet; Diseases of honey bee, , and their management; Honey extraction techniques; Physico-chemical analysis of honey; Other beneficial products from bee.

### Unit 2: Silk and Silk Production (Sericulture)

Different types of silk and silkworms in India; Rearing of *Bombyx mori* – Rearing racks and trays, disinfectants, rearing appliances, black boxing, Chawki rearing, bed cleaning, mountages, harvesting of cocoons; Silkworm diseases: Pebrine, Flacherie, Grasserie, Muscardine and Aspergillosis, and their management; Silkworm pests and parasites: Uzi fly, Dermestid beetles, and their management; Silk reeling techniques; Quality assessment of silk Fibre.

### Unit 3: Aquaculture

Brood stock management; Induced breeding of fish and prawn; Management of hatchery of fish; Management of nursery, rearing and stocking ponds; Preparation and maintenance of fish aquarium; Preparation of compound diets for fish; Role of water quality in aquaculture; Fish diseases: Bacterial, viral and parasitic; Preservation and processing of harvested fish; Fishery by- products.

#### **Unit 4: Dairy/Poultry Farming**

Introduction; Indigenous and exotic breeds; Rearing, housing, feed and rationing; Commercial importance of dairy and poultry farming; Varietal improvement techniques; Diseases and their management; Dairy/poultry farm management and business plan; Visit to any Dairy farm/Poultry farm.

#### **Unit-5 Lac Culture:**

Taxonomy and identification of Lac insect, Economic importance of lac, Bionomics of lac insect, crops of lac and host plants, method of lac cultivation, preparation of shellac, enemies of lac insect

#### **SUGGESTED READINGS**

1. Prost, P. J. (1962). *Apiculture*. Oxford and IBH, New Delhi.
2. Sericulture, *FAO Manual of Sericulture*.
3. Hafez, E. S. E. (1962). *Reproduction in Farm Animals*, Lea and Fabiger Publishers.
4. Srivastava, C. B. L. (1999). *Fishery Science and Indian Fisheries*. Kitab Mahal publications, India.
5. Sardar Singh, *Beekeeping in India*, Indian council of Agricultural Research, New Delhi.45
6. Dhyan Singh Bisht, *Apiculture*, ICAR Publication.
7. Knobil, E. and Neill, J. D. (2006). *The Physiology of Reproduction*, Vol. 2, Elsevier Publishers.
8. Dunham R. A. (2004). *Aquaculture and Fisheries Biotechnology – Genetic Approaches*. CABI publications, U.K.
- 9 Kumar and Nigam, *Economic and applied Entomology*



## **B.Sc. (Hons.) Zoology Semester V**

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**DSE-2**

**Biostatistics**

**Credit-4**

**Teaching Hrs -60**

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### **UNIT-1 Sampling (Data collection)**

- 1.1 primary Data
- 1.2 Secondary data
- 1.3 Frequency distribution and tally marks

### **UNIT-2 Classification & Tabulation**

### **UNIT-3 Representation of data**

- 3.1 Diagrammatic Representation: Histogram & Pie Diagram
- 3.2 **Graphical representation of Data**

### **UNIT-4. Measurement of central tendency**

- 4.1 Mean
- 4.2 Median
- 4.3 Mode

### **UNIT-5 Measurement of Variation**

- 5.1 Standard deviation
- 5.2 Standard error
- 5.3 Anova
- 5.4 Coefficient of variation

### **UNIT-6 Test of Significance**

- 6.1 Chi square test
- 6.2 Student 't' test

### **UNIT-7 Correlation and Regression**

**Practical based on DSE-1 & DSE-2****FM 75 (60 External + 15 Internal)**

<b>1</b>	<b>Identification of 2 fishes</b>	<b>10</b>
<b>2</b>	<b>Comment on any two: Silk or Tassar cocoon/lac stick/ Fish net and Gear/ Different types of poultry (photograph)</b>	<b>5 x 2 10</b>
<b>3</b>	<b>Identify and comment on two pests</b>	<b>10</b>
<b>4</b>	<b>Calculate or present the given data as per instruction</b>	<b>10</b>
<b>5</b>	<b>Sessional work</b>	<b>10</b>
<b>6</b>	<b><i>viva voce</i></b>	<b>10</b>

**Practical DSE-1 Economic Zoology**

1. Report on field Visit to sight of sericulture, Apiculture, Lac Culture and Aquaculture
2. Study of Infested Lac stick, Cocoon, honey comb, Infested fishes
3. Study of Paddy pests, Pest of Sugar cane
4. Study of some economically Important fishes

**Practical DSE-2 Biostatistics**

1. Determination of mean, median & mode
2. Determination of Deviation
3. Diagrammatic representation of statistical data

## **B.Sc. (Hons.) Zoology Semester VI**

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**C-13 Molecular Biology and Biotechnology**

**Credit-4**

**Teaching Hrs -60**

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### **UNIT-1. Nucleic Acids**

- 1.1 Mechanism of DNA replication in prokaryote
- 1.3 Mechanism of transcription in prokaryote
- 1.4 Mechanism of translation in Prokaryote

### **UNIT 2. Gene Regulation**

- 2.1 Concepts of operon ( Positive and Negative; Inducible & Repressible)
- 2.3 lac operon,
- 2.4 trp operon.

### **UNIT 3. Elementary idea of Repetitive DNA damage and DNA repair mechanism**

- 3.1 transposable genetic elements,
- 3.2 DNA damage by Mutagen
- 3.3 Mismatch repair
- 3.4 Thymine Dimer Repair

### **UNIT-4 Biotechnology**

- 4.1 Tools: Restriction enzymes, Cloning Vectors
- 4.2 Construction of recombinant DNA
- 4.3 Transgenic animals, a concept
- 4.4 DNA fingerprinting

## **B.Sc. (Hons.) Zoology Semester VI**

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**C-14 - Medical zoology**

**Credit-4**

**Teaching Hrs -60**

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### **UNIT-1 Life Cycle, Pathogenicity, clinical features, prophylaxis and control of pathogenic protozoan**

*1.1 Plasmodium*

*1.2 Entamoeba histolytica*

*1.3 Leishmania donovani*

*1.4 Giardia*

*1.5 Trichomona*

*1.6 Trypanosoma*

### **UNIT-2 Pathogenic Helminthes parasites, clinical Features ,Control and prophylaxis**

*2.1 Fasciola sp.*

*2.2 Taenia*

*2.3 Schistosoma*

*2.4 Wuchereria*

*2.5 Ascaries*

### **UNIT-3 Vector Biology**

a. Mosquito (Anopheles Female), Yellow Fever ,Dengue Fever,(Aedes)Filariasis  
(Culex Female ) Japnes B encephalitis

b. Plague

c. Epidimic typhus ticks (pediculus)

### **UNIT-4 Non Vector Diseases**

4.1Typhoid

4.2 Cholera

4.3 Small pox

4.4 HIV

4.5 Swine Flu

### **UNIT-5 General Account of Vaccine & Vaccination , Eradication Programme , drug Therapy and drug resistance**

## P 6 Practical based on C-13 & C-14

Credit: 4

Practical hrs: 60

FM 75 (60 External + 15 Internal)

1	Study of two transgenic animals through photographs	5 x 2	10
2	Study of transposition through Maize specimens /Photographs		10
3	Physiological experiment - Blood film preparation Determination of Bleeding and clotting time Glucose presence in Urine /serum		10
4	Study of parasites/vector – any two <i>Ascaris, Taenia solium, Fasciola hepatica, Anopheles/Culex</i>	5 x 2	10
5	Sessional work		10
6	<i>viva voce</i>		10

### Molecular biology & Biotechnology

1. Demonstration of DNA separation on Gel
2. Use of micropipette
3. Protein estimation by Colorimeter
4. Study of transposition through Maize specimens /Photographs
5. Study of Cloned animal through photographs
6. Study of transgenic animals through photographs

### Medical Zoology

1. Physical examination of urine
2. Blood film preparation
3. Determination of Bleeding and clotting time
4. Glucose presence in Urine and serum
5. Slides / museum specimens of parasites

### **Books Recommended**

1. B.D.Singh – A Text book of Biotechnology
- 2.. Alberts *et al*: Molecular Biology of the Cell (2008, Garland)
3. Karp: Cell and Molecular Biology (2008, John Wiley)
4. Lodish *et al*: Molecular Cell Biology (2008, Freeman)
- 5 K Park: Park's Textbook of Preventive and Social Medicine
- 6 Parasitology by KD Chatterjee 21 edition.

## B.Sc. (Hons.) Zoology Semester VI

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**DSE-3 Wild Life Conservation and Management Credit-4 Teaching Hrs -60 FM 60**

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**Unit 1:** Wild Life- Values of wild life- positive and negative; conservation ethics; Importance of conservation; causes of depletion, Red data book, IUCN, WWF.

**Unit 2:** Habitat analysis, Evaluation and management of wild life- Physical parameters; topography, Geology, Soil and water; Biological parameters: food, cover, forage, browse and cover; **Remote sensing and GIS.**

**Unit 3:** Population estimation: Population density, Natality, Birth Rate, Mortality, fertility, Faecal analysis of ungulates and carnivores; Faecal samples, slide preparation, Hair identification, Pug marks and census method.

**Unit 4:** National Organisations involved in wild life conservation; wild life Legislation- Wild protection act 1972, its amendments and implementation, Eco-tourism/ Wild life tourism in forests.

**Unit 5:** Management of excess population and translocation; bio-telemetry; Care of injured and diseased animal; Quarantine; common diseases of wild animal.

**Unit 6:** Protected areas National parks and sanctuaries, community reserve; important features of protected areas in India; Tiger conservation- Tiger reserves in India; Management challenges in Tiger reserve.

### **Recommended Books:**

- 1 Techniques for Wildlife Census in India: A Field Manual by W A Rdgers
- 2 Wildlife Ecology, Conservation, and Management by A. R. E. Sinclair and Graeme James Caughley
- 3 Conservation biology in theory and practice by Graeme James Caughley

## B.Sc. (Hons.) Zoology Semester VI

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**Question number Five, Six, Seven and Eight will be of long answer type**

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**DSE 4 Agrochemical and Pest Management**

**Credit-4**

**Teaching Hrs -60**

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### **UNIT-1 Fundamentals of Pest management**

Pest: Definition, types of pest according to damage (sub-economic, Occasional, perennial, economic threshold)

### **UNIT-2 Practical approach to pest management**

General morphology of different types of insect, biting and chewing type, Piercing & sucking type of mouth parts, integrated pest management: Cultural, biological, chemical, genetic control

**Agrochemicals:** common pesticides and insecticides, Nomenclature, Mode of action, tools & techniques for pesticide application, measurement of insecticides Toxicity by LD<sub>50</sub>

### **UNIT-3 Study of Pest in laboratory and field**

Visit to agriculture field to study biology, damage and management practices of pests of agriculture crops

Rearing of stored grain pests and study of different stages

Role of Pheromone in pest surveillance

### **Recommended Books**

#### **AGROCHEMICAL & PEST MANAGEMENT**

1. Pradhan S (1969) Insect pest of crops, National book trust, India Book house
2. Dennis, S. Hill (2005) Agricultural Insect Pests of Tropics and their management
3. Atwal, A.S. (1993) Agriculture pest of India and South East Asia, Kalyani Pub. New Delhi
4. Pedigo L.P. (2002) Entomology and Pest management Prentice hall publication
5. Kumar and Nigam - A text book of Agricultural Entomology Emkay Publication.



# Practical based on DSE- 3 and 4

FM 75 (60 External + 15 Internal)

1	Identification of wild fauna on the basis of pug mark/Dung etc.	10
2	Quadrant method of flora study	05
3	Collection preservation and slide preparation of pest	08
4	Study of infested plants / part of the plant	05
5	Study of instrument used in pest management	07
6	Determination of LD 50 OR LC 50 from the generated data	05
6	Sessional work	10
7	<i>viva voce</i>	10

## DSE-3 PRACTICALS

Credit 2 Practical Hrs 30

1. Identification of flora, mammalian fauna, avian fauna,
2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Binoculars, GPS (Global Positioning System, various types of cameras and lenses)
3. Familiarization and study of animal evidences in the field, identification of animals through pug marks, hoof marks, scats, pellet groups, nest antlers etc.
4. Demonstration of different field techniques for flora and fauna

## DSE-4 PRACTICALS

Credit 2 Practical Hrs 30

1. Trip to ICAR governing field of your locality / FCI
2. Collection preservation and slide preparation of pest
3. Study of infested plants / part of the plant
4. Study of instrument used in pest management
5. Determination of LD 50 OR LC 50 from the generated data.