

**RADHA GOVIND UNIVERSITY**  
**RAMGARH, JHARKHAND**

**DEPARTMENT OF ZOOLOGY**



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

B.Sc. (Honours in Zoology)

**With effect from 2018-2021**

**RADHA GOVIND UNIVERSITY**  
**RAMGARH**  
**RADHA GOVIND UNIVERSITY**

## Details of B.Sc. Honours Courses under CBCS

Duration of Course -3 yrs

Total number of semester -06

Total no. of papers

- |  |                                    |
|--|------------------------------------|
| a. C- Core                                       | -14 ( Theory) 6 ( Practical)       |
| b. G- Generic elective                           | -4( 1 in each Semester)            |
| c. GEP ( Generic elective paper)                 | -4 (1 in each semester)            |
| d. AECC( Ability Enhancement compulsory course)  | -2 ( 1 each in semester I & II )   |
| e. SEC ( Skill enhancement course)               | -2(1 each in semester I & II)      |
| f. DSE ( Discipline specific elective theory)    | -4 ( 2 in each in semester V & VI) |
| g. DSEP (Discipline specific elective Practical) | -2 (1 each in Semester V & VI)     |

Generic Elective paper will be selected by the students and will continue from semester I to semester IV

After completion of course in Honours, candidate will get degree in Zoology Hons. With Chem/Phy/Botany/- as per selection of generic elective paper

All candidate (Examinees) have to complete 140 credits in three yrs

A students can take up to extra 20 credits i.e maximum credits 160 to enhance his/her study

**General Instructions for question setters  
for Theory examination Core Course**

- **In all eight question are to be set of equal values and a total of four questions are to be answered. Question no. 1& 2 is compulsory.**
- **Q. No. 1 will be of short type from entire syllabi in the form of multiple choices/ True or false /fill in the blanks of each equal mark. (Total :15 marks)**
- **Q.No. 2 will be of short answer type with six option covering entire paper examinee has to answer any three.(5 marks X 3 questions)**

**Rest six question will be of long type and examinees are required to answer any two by selecting not more than one from each group**

**DSE**

- **In all eight question are to be set of equal values and a total of four questions are to be answered. Question no. 1& 2 is compulsory.**
- **Q. No. 1 will be of short type from entire syllabi in the form of multiple choices. True or false /fill in the blanks of each equal mark. (Total :15 marks)**
- **Q.No. 2 will be of short answer type with six option covering entire paper examinee has to answer any three.(5 marks X 3 questions)**

**Rest six question will be of long type and examinees are required to answer any two by selecting not more than one from each group**

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

**(Six Semester Course )**

**SEMESTER-I**

<b>COURSE</b>	<b>Code Of Papers</b>	<b>Name of Papers</b>	<b>Credit</b>	<b>Full Marks (I+E)</b>	<b>Pass Marks (%)</b>
<b>(A) CORE Course</b>	<b>C-1</b>	<b>Systematics &amp; Diversity of Non chordate</b>	<b>04</b>	<b>75 (15+60)</b>	<b>40</b>
	<b>C-2</b>	<b>Principle of Ecology</b>	<b>04</b>	<b>75(15+60)</b>	<b>40</b>
	<b>P-1</b>	<b>Practical based in C-1 &amp; c-2</b>	<b>04</b>	<b>50(10+40)</b>	<b>40</b>
<b>(B) AECC Ability Enhancement Compulsory Course</b>	<b>AECC-1</b>	<b>Communicative English /MIL</b>	<b>02</b>	<b>50(10+40)</b>	<b>40</b>
<b>(C) Generic Elective</b>	<b>GE-1</b>	<b>Chemistry//Botany</b>	<b>04</b>	<b>75(15+60)</b>	<b>40</b>
		<b>Practical-GE</b>	<b>02</b>	<b>25(5+20)</b>	<b>40</b>
		<b>Total credits</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>Core Course</b>	<b>C-3</b>	<b>Cell Biology</b>	<b>04</b>	<b>75(15+60)</b>	<b>40</b>
	<b>C-4</b>	<b>Diversity of Chordates</b>	<b>04</b>	<b>75(15+60)</b>	<b>40</b>
	<b>P-2</b>	<b>Practical based on C-3 &amp; C-4</b>	<b>04</b>	<b>50(10+40)</b>	<b>40</b>
<b>(B) AECC Ability Enhancement Compulsory Course</b>	<b>AECC-2</b>	<b>Environmental Science</b>	<b>02</b>	<b>50(10+40)</b>	<b>40</b>
<b>(C) Generic Elective</b>	<b>GE-2</b>	<b>Chemistry//Botany</b>	<b>04</b>	<b>75(15+60)</b>	<b>40</b>
		<b>Total</b>	<b>20</b>	<b>25(5+20)</b>	<b>40</b>
				<b>350</b>	

### SEMESTER –III

<b>COURSE</b>	<b>Code Of Papers</b>	<b>Name of Papers</b>	<b>Credit</b>	<b>Full Marks (I+E)</b>	<b>Pass Marks (%)</b>
<b>Core Course</b>	<b>C-5</b>	<b>Physiology</b>	<b>04</b>	<b>75 (15+60)</b>	<b>40</b>
	<b>C-6</b>	<b>Biochemistry</b>	<b>04</b>	<b>75(15+60)</b>	<b>40</b>
	<b>C-7</b>	<b>Endocrinology</b>	<b>04</b>	<b>75(15+60)</b>	<b>40</b>
	<b>P-3</b>	<b>Practical based on C-5,C-6&amp; C-7</b>	<b>06</b>	<b>75(15+60)</b>	<b>40</b>
<b>(B) Skill Enhancement Course</b>	<b>SEC-1</b>	<b>As per Univ. Rule</b>	<b>02</b>	<b>50(10+40)</b>	<b>40</b>
<b>Generic Elective</b>	<b>GE-3</b>	<b>Chemistry/ /Botany</b>	<b>04(T)</b>	<b>75(15+60)</b>	<b>40</b>
	<b>GE-3P</b>		<b>02</b>	<b>25(5+20)</b>	<b>40</b>
		<b>Total</b>	<b>26</b>	<b>450</b>	

### SEMESTER -IV

<b>COURSE</b>	<b>Code Of Papers</b>	<b>Name of Papers</b>	<b>Credit</b>	<b>Full Marks (I+E)</b>	<b>Pass Marks (%)</b>
<b>Core Course</b>	<b>C-8</b>	<b>Genetics</b>	<b>04</b>	<b>75 (15+60)</b>	<b>40</b>
	<b>C-9</b>	<b>Evolution</b>	<b>04</b>	<b>75(15+60)</b>	<b>40</b>
	<b>C-10</b>	<b>Animal behaviour</b>	<b>04</b>	<b>75(15+60)</b>	<b>40</b>
	<b>P-4</b>	<b>Practical based on C-8,C-9&amp; C-10</b>	<b>06</b>	<b>75(15+60)</b>	<b>40</b>
<b>(B) Skill Enhancement Course</b>	<b>SEC-2</b>	<b>As per Univ. Rule</b>	<b>02</b>	<b>50(10+40)</b>	<b>40</b>
<b>Generic Elective</b>	<b>GE-4</b>	<b>Chemistry/ /Botany / Physics</b>	<b>04</b>	<b>75(15+60)</b>	<b>40</b>
	<b>GE-4P</b>	<b>Practical (GE)</b>	<b>02</b>	<b>25(5+20)</b>	<b>40</b>
				<b>450</b>	

### SEMESTER V

<b>COURSE</b>	<b>Code Of Papers</b>	<b>Name of Papers</b>	<b>Credit</b>	<b>Full Marks (I+E)</b>	<b>Pass Marks (%)</b>
<b>Core Course</b>	<b>C-11</b>	<b>Immunology</b>	<b>04</b>	<b>75 (15+60)</b>	<b>40</b>
	<b>C-12</b>	<b>Developmental Biology</b>	<b>04</b>	<b>75(15+60)</b>	<b>40</b>
	<b>P-5</b>	<b>Practical based on C-11&amp; C-712</b>	<b>04</b>	<b>50(10+40)</b>	<b>40</b>
<b>Discipline specific Elective</b>	<b>DSE-1</b>	<b>Economic Zoology</b>	<b>04</b>	<b>75(15+60)</b>	<b>40</b>
	<b>DSE-2</b>	<b>Biostatistics</b>	<b>04</b>	<b>75(15+60)</b>	<b>40</b>
	<b>P-6</b>	<b>Practical based on DSE-1 &amp; DSE-2</b>	<b>04</b>	<b>50(10+40)</b>	<b>40</b>
		<b>Total</b>	<b>24</b>	<b>400</b>	

### SEMESTER VI

<b>COURSE</b>	<b>Code Of Papers</b>	<b>Name of Papers</b>	<b>Credit</b>	<b>Full Marks (I+E)</b>	<b>Pass Marks (%)</b>
<b>Core Course</b>	<b>C-13</b>	<b>Molecular biology &amp; Biotechnology</b>	<b>04</b>	<b>75 (15+60)</b>	<b>40</b>
	<b>C-14</b>	<b>Medical Zoology</b>		<b>75(15+60)</b>	<b>40</b>
	<b>P-7</b>	<b>Practical based on C-13 &amp; C-14</b>	<b>04</b>	<b>50(10+40)</b>	<b>40</b>
<b>Discipline specific Elective</b>	<b>DSE-1</b>	<b>Wild Life conservation &amp; Management</b>	<b>04</b>	<b>75(15+60)</b>	<b>40</b>
	<b>DSE-2</b>	<b>Pest &amp; Pest management</b>	<b>04</b>	<b>75(15+60)</b>	<b>40</b>
	<b>P-8</b>	<b>Practical based on DSE-1 &amp; DSE-2</b>	<b>04</b>	<b>50(10+40)</b>	<b>40</b>
		<b>Total</b>	<b>24</b>	<b>400</b>	



## **Books Recommended**

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

1. Dalela & 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 & 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., Golding, D.W. and Spicer, J.L.I. (2002) The Invertebrates; E.J.W, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979) Invertebrate structure & function. II edition. E.L.B.S and Nelson
4. Boolotian and Stiles: College Zoology (10<sup>th</sup> Ed. 1981, Macmillan)
5. Campbell & Reece: Biology (7<sup>th</sup> edn. 2005, Pearson)
6. Nigam: Biology of Non-chordates (1997, S Chand)
7. Miller and Harley: Zoology (6<sup>th</sup> Ed. 2005, W.C. Brown)
8. Parker & Haswell: Text Book of Zoology, Vol. I (2005, Macmillan)

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

---

**Principle of Ecology (Credit 4)**

**Hours of teaching**

**4X15=60 hrs FM:60**

---

**Group A**

**UNIT- 1. General concepts**

- 1.1 Components of ecosystem
- 1.2 Energy flow in ecosystem
- 1.3 food chain and food web, Food Pyramid
- 1.4 Bio- Geochemical cycle
  - 1.4.1 Water Cycle
  - 1.4.2 Gaseous Cycles- Carbon and Nitrogen
  - 1.4.3 Sedimentary Cycle- Phosphorous and sulphur

**UNIT- 2. Population and communities**

- 2.1 Population characteristics: Density, Natality, Mortality, Age pyramid and growth curve
- 2.2 Ecological succession and concept of climax

**Group B**

**UNIT- 3. Pollution**

- 3.1 Sources and impact of environmental pollutants- air & water
- 3.2 Global environmental changes- greenhouse gases and their effects
- 3.3 Acid rains

**UNIT- 4. Natural resources**

- 4.1 Soil & water and their conservation
- 4.2 Biodiversity- benefits, hotspots, threats and conservation
- 4.3 Renewable and Non Renewable Source of Energy



## Suggested Practicals

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

Sycon (As an example of parazoa), Hydra Fasciola, Ascaris, Hirudinaria, Hermit Crab, Scorpion, Unio, Sepia, Aplysia, Loligo, Sea Urchin, Ophiothrix (Brittle star)

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

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

### 3. Dissection:

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

### 4. Mounting

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

### B. Ecology

1. Collection & Identification of different biotic component of pond Ecosystem  
2. Estimation of dissolved oxygen.  
3. Estimation of carbon dioxide  
4. Determination of pH of water sample

**B.Sc. (Hons.) Zoology Semester II**  
**Core Course C-3**

---

**C-3-Cell Biology**

**Credit-4**

**Hours of teaching 4X15=60**

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

---

**Group A**

**Cell Biology**

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

- 1.1 Methods in cell biology: Elementary idea of microscopy (Light, Electron )and cell fractionation
- 1.2 Structure and function of plasma membrane and cell junctions
- 1.3 Introduction to cell organelle: Endoplasmic reticulum, Golgi complex, Lysosome Ribosomes & Mitochondria

**UNIT-2.Nucleus**

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

**Group B**

**UNIT - 3. Cell Division**

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

**UNIT-4. Elementary idea of**

- 4.1 Apoptosis &
- 4.2 Necrosis

**Group A**

**UNIT-1. Protochordates**

- 1.1 General characters and Affinities of Amphioxus
- 1.2 Retrogressive metamorphosis in Herdmania

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

- 2.1 Amphibians
- 2.2 Reptiles
- 2.3 Mammals

**UNIT- 3. Fish & Amphibians**

- 3.1 Difference between cartilaginous & bony fishes
- 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

**Group B**

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

- 4.1 Poisonous & Non-poisonous Snakes of India, Poison's Apparatus and biting Mechanisms
- 4.2 Flight Adaptation and mechanisms of flight
- 4.3 Structure and Affinities of Prototheria & Metatheria
- 4.4 Comparative anatomy of heart, 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 & Harley: Zoology (6th ed. 2005, W.C. Brown)
7. Nigam: Biology of Chordates (1997, S Chand)
8. Parker & Haswell, A 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., Parsons, T.S., The vertebrate body, 6<sup>th</sup> Edition, CBS publishing, Japan Ltd., 1986
11. Sinha, A.K., & Adhikari, S and Ganguli, B.B Biology of Animals Vol.II New Central Agency, Calcutta
12. Young, J.J. The life of Vertebrates, 3<sup>rd</sup> Edition, ELBS with Oxford Press, 1981
13. Vishwanath – vertebrate Zoology

## B.Sc. Semester-II

### P-2 Practical based on C-3 & C-4

Credit-4

Working hours -60

FM: 40 External + internal 10

#### Practicals

#### Dissection

1. Dissection :	08
2. Mounting :	04
3. Spotting: 2 specimens; 2 bones , 1 slides    2X5    =	10
4. Preparation of cytological slide	08
5. Practical Record	05
6. <u>Viva Voce:</u>	<u>05</u>
	<u>40</u>

## **Suggested Practicals**

### **Cell Biology**

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, Turtle, Hydrophis, Krait, Viper, Naja, Python, Water Snake, Rat Snake
10. Aves :Ostrich model or nay ave model
11. Prototheria Models of Duck bill platypus ,spiny ant eater
12. Bones of Amphibia, Reptiles, Aves and Mammal
13. Study of histological slides : Skin ,Bone ,Lung, Stomach, Intestine, Liver, Kidney of mammals
14. Dissection of local bony fishes ; Afferent and efferent and nervous system
15. Mounting of Scale

**Group A**

**UNIT\_1. Digestion**

1.1 : 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 Composition of blood and lymph

2.4 Blood groups and Blood clotting

2.5 Cardiac cycle /ECG

**Group B**

**UNIT3. Renal & Reproductive Physiology**

**3.1** Histo-Physiology of Kidney

**3.2** Histo-Physiology of Testes

**3.3** Histo-Physiology of Ovary

**3.4** Menstrual cycle in human

**UNIT-4. Nerve physiology**

4.1 Propagation of nerve impulse in Myelinated and non- myelinated nerve fibers

4.2 Synapse & Synaptic Transmission

**Group A**

**UNIT-1. Biomolecules**

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

**UNIT-2. Enzymes**

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

**Group B**

**UNIT-3. Nucleic acids**

- 3.1. DNA structure: DNA double helix (Watson and Crick model)
- 3.2. Types of RNA: m RNA, t RNA& r RNA

**UNIT-4. Metabolic path way**

- 4.1 Glycolysis
- 4.2 Kreb's cycle
- 4.3 Beta oxidation of fatty acid

## B.Sc. Semester III

---

**C-6 Endocrinology**

**Credit 4(T)**

**Teaching: 60**

**FM: 75 ( 60+15)**

---

### Group A

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

- 1.1 Hormones and its classification
- 1.2 Pheromones
- 1.3. General mechanism of hormone action

### Group B

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

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

#### **UNIT-3. Gastrointestinal hormones (Gastrin, Secretin, CCK & Motilin)**

## B.Sc Semester III

---

**SEC -1 (CREDITS 2)**

**Teaching hrs: 30**

**FM: 50 ( 40 External + 10 Internal )**

---

## **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. Chatterjee: Medical physiology
6. Guyton – a book on 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
4. Nooris

**P-3 Practical based on C-5, C-6 & C-7**

**Credits 2+2+2=6**

**Total Practical hours -90**

**F.M.: 60 External + Internal 15**

<b>Practicals</b>	<b>Marks Distribution</b>
<b>1. Physiology Experiment</b>	<b>15</b>
<b>2. Biochemistry practical</b>	<b>15</b>
<b>3. Spotting (5 endocrine/organ Slides)</b>	<b>5X3 = 15</b>
<b>4. Practical Record</b>	<b>08</b>
<b>5. Viva Voce</b>	<b>07</b>

**Suggested Practicals**

**Mammalian Physiology**

1. Preparation of Haemin Crystal
2. RBC count by using haemocytometer
3. Estimation of Haemoglobin using Sahil's method
4. Record of blood pressure by Sphygmomanometer
5. Study of permanent slide of transverse section/L.S .of organs:

Skin, Lung , Stomach, Intestine, Liver, Kidney,

**Biochemistry**

1. Detection of biomolecules in the unknown sample –
  - a. Glucose
  - b. Amino acids
  - c. Ptoteins
  - d. Lipids
  - e. Citric Acids (Antioxidants)
2. Quantitative estimation of glucose
3. Separation of Chlorophyll by chromatography

**Endocrinology**

1. Study of permanent slide of Endocrines gland:  
Thyroid, Islets of Langerhans , Adrenal, Testes and Ovary

## B.Sc. Semester IV

---

**C-8 : Genetics**

**Credit-4**

**Total teaching hrs: 60**

**FM:60**

---

### Genetics

#### Group A

#### 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 Multipleallelism

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

#### Group B

#### UNIT-3 Sex Determination

3.1 sex chromosomes and basis of sex determination : XX/XO, XX/XY, ZZ/ZW

3.2 dosage compensation

#### UNIT-4. Mutation

4.1 Structural and numerical alterations of chromosomes and related disorder

4.2 Genetic counselling

**Group-A**

**UNIT-1 History & 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 Lamarkism
- 2.2 Dawarnism
- 2.3 Neo Darwinism
- 2.4. Source of Variation : Mutation & Recombination
- 2.5 Sexual Isolation

**Group B**

**UNIT-3 . Population Genetics**

- 3.1 Hardy Weinberg Law of Equilibrium
- 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

---

**C-10 Animal Behaviour**

**Credit 4(T) Teaching Hrs.:60**

**FM: 75 (60+15)**

---

### Group A

#### **UNIT-1. Concepts and pattern of Behaviour**

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

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

- 4.1 Neural control
- 4.2 hormonal control

#### **UNIT-3 Social organisation**

- 3.1 Evolution of Social organization
- 3.2 Social organization in honey bee and Termites
- 3.2 Communication in animals (Chemical , Audio & Visual)

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

- 4.1 Migration in Fishes and Birds
- 4.2. Biological Rhythms
- 4. 3.Parental Care in fishes and Amphibia

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

---

**SEC-2 Credits 2 Hours of Teaching 30 FM: 50 (External 40 + Internal 10)**

---

**P-4 Practical based on C-8, C-9 & C-10**  
**FM (External 60+ Internal 15)**

**Credit: 6(2+2+2)**

**Total practical hrs.:90 (external :60 Internal:15)**

**Practicals**

**Marks Distribution**

---

<b>1. Verification of law of segregation</b>	<b>10</b>
<b>2. Identification &amp; comment on given fossil</b>	<b>10</b>
<b>Analogous/homologous organ</b>	
<b>3. Pedigree analysis</b>	<b>10</b>
<b>4. Comments on Bee Hive/termite mound</b>	<b>05</b>
<b>Specimens showing behaviour</b>	
<b>5. Experiment on geotaxis/phototaxis</b>	<b>05</b>
<b>6. Sessional Record</b>	<b>10</b>
<b>7. <u>Viva Voce</u></b>	<b><u>10</u></b>

## **Suggested Practical**

### **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.
4. Genotype analysis in the pedigree chart of the Victorian family affected with haemophilia
5. Study of Colour blind by Ishihara

### **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, Archeopteryx *Brontosaurus*., *Archaeopteryx*, *Dinosaurs*
3. Evolution of Horse – through models
5. Study of Serial homology exhibited by teeth and appendages
6. Study of Homologous and Analogous 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. Specimen showing Behaviour – Prey mantis , Hippocampus ,Alytes, Migratory fish
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& Jones: Essential Genetics: A Genomic Perspective (2002, Jones & Bartlett)
5. Russell: Genetics (2002, Benjamin Cummings)
6. Snustad& 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&Ramnath)
4. Strickberger: Evolution (2004, Jones & Bartlett)

### **Animal Behaviour**

1. Drickamer& Vessey : Animal Behaviour – concepts, processes and methods (2nd ed. 1986, Wadsworth,)  
210
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 V

---

<b>C-11</b>	<b>Immunology</b>	<b>Credit- 4 (T)</b>	<b>Hours of Teaching 60</b>
-------------	-------------------	----------------------	-----------------------------

---

### **Immunology**

#### **Group A**

#### **UNIT-1 . Types of 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

#### **Group B**

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

3.1 Antigen

3.2 Immunoglobulins: types, structure and function

3.3 Complement System

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

4.1 Structural organization of MHC complex

4.2 Antigen processing and presentation

4.3 Monoclonal Antibody

4.4 ELISA

### Group A

#### UNIT-1 Early embryonic development

- 1.1 Spermatogenesis
- 1.2 Oogenesis
- 1.3 Pre fertilization Events: Attraction of gametes, Fertilizin – Antifertilizin Interaction, capacitation , Acrosomal Reaction , Amphimixis
- 1.4 Types of cleavage
- 1.5 Role of yolk in cleavage
- 1.6 Construction of fate map

#### UNIT\_2 Late embryonic Development

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

### Group –B

#### UNIT-3, Post Embryonic Development

- 3.1 Metamorphosis in Insect
- 3.3 Regeneration

#### UNIT-4 Embryo transfer technology

- 4.1. Principles of collections of Umbilical cord, gametes and embryos
- 4.2. In Vitro fertilization
- 4.3. Embryo transfer technology

## Practical –P5

---

**P-5 Practical based on C-11 & C-12**  
Credits 3+3=6

**FM 75 ( External -40 + Internal 10)**  
Total Practical hrs-60

---

<u>Practicals</u>	<u>Marks Distribution</u>
1. Comment on Embryological slides (02) 02X05 =	10
2. Immune cells in Blood Film preparation	05
3. Histology of slides/photographs of thymus & spleen	05
4. Study of types of placenta through photographs	05
5. Sessional Records	07
6. <u>Viva Voce</u>	<u>08</u>

40

### Suggested practicals

#### Developmental biology & Immunology

1. Study of chick embryological slides
2. Study of WM & section of developmental stages of frog through permanent slides Morula gastrula Cleavage , Neurula , Tadepole
3. Preparation of blood flim to study various types of blood cells
4. Histological study of spleen,thymus& lymph nodes through slides/ photographs 5. Study of placenta through photographs

## **Suggested Books**

### **Developmental Biology**

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)

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

- 1.1 Varieties of honey bees in India
- 1.2 Setting up an apiary Rearing equipments
- 1.3 Diseases of honey bee and their management
- 1.4 Beneficial products of honey bee;

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

- 2.1 Different types of silk and silkworms in India;
- 2.2 Host plants & Rearing of *Bombyx mori* –
- 2.3 Silkworm diseases: Pebrine, Flacherie, Muscardine and their management;
- 2.4 Silkworm pests and parasites: Uzi fly and their management;

**Unit-3 Lac Culture**

- 3.1 Species of Lac Insect (taxonomy & Identification)
- 3.2 Host Plants, Methods of Rearing /Cultivation and crops of lac in Jharkhand
- 3.3 Enemies of Lac insect
- 3.4 Economic Importance of Lac

**SUGGESTED READINGS**

- 1. Prost, P. J. (1962). *Apiculture*. Oxford and IBH, New Delhi.
- 2. Sericulture, *FAO Manual of Sericulture*.
- 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. Kumar & Nigam-Economic and applied entomology

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

1.1 Primary Data

1.2 Secondary data

**UNIT-2 Graphical Representation of data**

2.1 Diagramatic Representation: Histogram & Pie Diagram

**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

**UNIT-6 Test of Significance**

6.1 Chi square test

6.2 student 't' test

**Suggested Books**

1. Mariyappam – Biostatistics (Pearson Publications )
2. P.N.Arora , P.K.Mallhotra – Biostatistics
3. Rout K. Sourya – Biostat & Human health

---

**Practical based on DSE-1 & DSE-2 FM 75 ( External 40 + Internal 10)**

---

<b>Practicals</b>	<b>Marks Distribution</b>
<b>1. Identification &amp; comments on cast of Honey bees/</b>	<b>05</b>
<b>2. Comments on silk cocoon /life cycle</b>	<b>05</b>
<b>3. Comments on life cycle of lac insect /lac stick /lac</b>	<b>05</b>
<b>4. Biostatistics – Calculation / presentation of Data as per instruction</b>	<b>10</b>
<b>5. Sessional Records/Collection/report of visit</b>	<b>07</b>
<b>6. Viva Voce</b>	<b>08</b>
	<b><u>40</u></b>

**Suggested Practicals**

**Practical DSE-1 Economic Zoology**

1. Report on field Visit to sight of sericulture,
2. Apiculture – life cycle & honey comb, collection
3. Lac Culture- Study of Infested Lac stick, Cocoon collection
4. Silk worm – life cycle & collection

**Practical DSE-2 Biostatistics**

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

**C-13 (Molecular Biology & Biotechnology )**

**Group A**

**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 & Negative; Inducible & Repressible)
- 2.3 Lac operon
- 2.4 trp operon

**Group B**

**UNIT 3. DNA damage & DNA 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

**Group A**

**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 *Trypanosoma*

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

- 2.1 *Taenia*
- 2.2 *Wuchereria*
- 2.3 *Ascaris*

**Group B**

**UNIT-3 Vector Biology**

- 3.1 Mosquito (Anopheles Female), Yellow Fever ,Dengue Fever,(Aedes) Filariasis (Culex Female )
- 3.2 Epidemic typhus ticks (pediculus)

**UNIT-4 Non Vector Diseases**

- 4.1 Typhoid
- 4.2 Cholera
- 4.4 HIV
- 4.5 Swine Flu

**UNIT-5 General Account of Vaccine & Vaccination, Eradication Programme (Polio & AIDS)**

---

**Practical based on C-13 & C-14**

**Credit: 4    Practical hrs: 30    FM: (40 External + 10Internal)**

---

<u>Practical</u>	<u>Marks Distribution</u>
1. Comments on transgenic animals /cloned animals photographs /maize specimens /photographs of transposition (2)    5X2=	10
2. Spotting on specimens & slides of Ascaris /Teania/mosquito Parasitic Protozoa    2 specimens 2slides    4X 2.5	10
3. Sessional records	10
4. <u>Viva Voce</u>	<u>10</u>
	<u>40</u>

**Suggested Practicals**

**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.Slides of parasites
2. Museum specimens of helminthes parasites

## **Recommended Books**

### **Molecular biology & biotechnology**

- 1. B.D.Singh – A Text book of Biotechnology**
2. .Albertset *al*: Molecular Biology of the Cell (2008, Garland)
3. Karp: Cell and Molecular Biology (2008, John Wiley)
4. Lodishet *al*: Molecular Cell Biology (2008, Freeman)

### **Medical Zoology**

- 1. Parasitology by K.D.Chaterjee 21 edition**

---

## **DSE-3WILD LIFE CONSERVATION AND MANAGEMENT**

**CREDITS: -4 Hours of Teaching -60 FM: 75 (External -60+ internal 15)**

---

### **THEORY**

**Unit 1:** Wild Life- Importance of conservation; Depletion & conservation

**Unit 2:**, Faecal analysis of ungulates and carnivores; Faecal samples, slide preparation, Hair identification, Pug marks and census method.

**Unit 3:** 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/Bird Watching.

**Unit 4:** Protected areas -National parks and sanctuaries, community reserve; Important features of protected areas in India;

Project Tiger - Tiger reserves in India ;

Project Elephant

Red data book, IUCN, WWF

#### **Recommended Books**

1. **Techniques for wild life census in India: A field manual by W A Rdgers**
2. **Wild life ,conservation & management by A. R.E. Sinclair and Graeme James Caughley**
3. **Conservation Biology in Theory and practice by Graeme James Caughley**

---

**DSE-4: PEST & PEST MANAGEMENT****CREDITS: -4****Hrs. of Teaching: 60****FM: 75 (60External 15Internal)**

---

**Group A****UNIT-1 Fundamentals of Pest management**

Pest :Definition ,types of pest according to damage (sub-economic, Occassional, perennial

**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 : Mechanical, biological, chemical, genetic control.

Common pesticides and insecticides , Nomenclature , Mode of action ,

Tools & techniques for pesticide application

**Group B****UNIT-3 Study of Pest in laboratory and field**

Biology, damage and management of Pest of agriculture crops

**Recommended Books****PEST & PEST MANAGEMENT**

1. Pradhan S 91969)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. PedigoL.p.(2002)Entomology & Pest management Prentice hall publication
5. Kumar & Nigam –A Text Book of Entomology –Emkay Publications

---

**Practicals based on DSE-3 and DSE-4**  
**FM: 50 ( external 40 + Internal 10)**

---

<b>Practicals</b>	<b>Marks Distribution</b>
1. Identification of wild fauna on the basis of pug marks/pellet/nest	10
2. Comments on the common pest (2)	10
3. Comment on the photographs of endangered species	05
4. Comment on the equipment used in wild life study/pest management	05
5. Seasonal Records	05
6. Viva Voce	05
	<u>40</u>

**DSE-3 Wild Life Conservation & Management**

**Suggested Practicals**

**DSE-3 PRACTICALS**

1. Identification of mammalian fauna, avian fauna (Bird Watching) in near by national park./Zoological park /sanctuary
2. Demonstration of basic equipment needed in wildlife studies (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, pellet groups, nest, antlers etc. 4.visits to National park/ zoological park /protected areas
5. Study of endangered species through photographs

**DSE-4: Pest & Pest Management**

**Suggested Practicals**

1. Study of pest & infested plants
2. Collection, preservation and slide preparation of pest
3. Trip to ICAR governing field of your locality / FCI/agricultural field for study of pest
4. Study of instrument used in pest management (IPM)