

## Syllabus for B.Sc. I (Zoology)

### Preamble:

- 1) To impart the knowledge of animal science to the pupils.
- 2) To make the pupils to use the knowledge in their daily life.
- 3) To make the pupils aware of natural resources and environment.
- 4) Application of knowledge in Zoology for nutrition, agriculture & livestock.
- 5) To provide practical experiences which form a part of their learning processes.
- 6) To develop aptitude for scientific work & ability to pursue studies far beyond graduation.
- 7) To encourage the pupils to take life science as a carrier which is the need now a day.
- 8) To make the pupils fit for the society.
- 9) In Autonomous the addition of more syllabus will be very helpful to students which will improve their knowledge in depth.
- 10) To inculcate in the student's highest values of life, understand the human niche in nature and apply the knowledge of life sciences for betterment of society.
- 11) To inspire students to reach frontiers of life sciences through commitment, hard work, study and research.

### General Objectives of the Program:

1. To impart knowledge is the basic aim of education. The students are expected to acquire the knowledge of animal science, natural phenomenon, manipulation of nature & environment by man.
2. Understanding the scientific terms, concepts, facts, phenomena & their interrelationships.
3. Applications of the knowledge.
4. To develop skills in practical work, experiments & laboratory materials, instruments.
5. To develop interests in the subject & scientific hobbies.
6. To develop scientific attitude which is the major objective. This makes the students open minded, critical observations, curiosity, thinking etc.
7. Abilities to apply scientific methods, collection of scientific data, problem solving, organize science exhibitions, clubs etc.
8. Appreciation of the subject, contributions of scientists, scientific methods, scientific programs etc.

### **Program Outcomes:**

1. The student will graduate with proficiency in the subject of his choice.
2. The student will be eligible to continue higher studies in his subject.
3. The student will be eligible to pursue higher studies abroad.
4. The student will be eligible to appear for the examinations for jobs in government organizations.
5. The student will be eligible to appear for jobs with minimum requirement of B. Sc. Program.

### **Program Specific Objectives:**

1. The students are expected to understand the fundamentals, principles, concepts and recent developments in the Zoology.
2. The practical course is framed in relevance with the theory courses to improve the understanding of the various concepts in Zoology.
3. It is expected to inspire and boost interest of the students in Zoology.
4. To develop the power of appreciations, the achievements in science and role in nature and society.
5. To enhance student sense of enthusiasm for science and to involve them in an intellectually stimulating experience of Course in a supportive environment.

### **Program Specific Outcomes:**

1. Understand the basics of Zoology.
2. Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learned in the classrooms.
3. Develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Zoology.
4. Identify their area of interest in academic, research and development.
5. Perform job in various fields' like science, environment, education, banking, business and public service, etc. or be an entrepreneur with precision, analytical mind, innovative thinking, clarity of thought , expression, and systematic approach.

- Title:** Zoology
- Year of Implementation:** The syllabus will be implemented from June, 2018 onwards.
- Duration:** The course shall be a full time.
- Pattern:** Semester examination.
- Medium of Instruction:** English.
- Structure of Course:**

**B.Sc. – I**

**Semester –I**

Paper Title	Theory			Practical		
	Paper Code	Lectures Per week	Credits	Paper Code	Lectures per week	Credits
<b>Animal Diversity I</b>	Paper-I: BZT101	5	2	Practical Paper – I : BZP103	4	2
Physiology	Paper-II: BZT102		2			

**B.Sc. – I**

**Semester –II**

Paper Title	Theory			Practical		
	Paper Code	Lectures Per week	Credits	Paper Code	Lectures Per week	Credits
Cell Biology and Evolutionary Biology	Paper-III: BZT201	5	2	Practical Paper – II: BZP203	4	2
Genetics	Paper-IV: BZT202		2			

**Note: B: B. Sc. T=Theory and P= Practical**

**2. Titles of papers**

**B.Sc. – I Semester – I**

**Theory: 36 lectures, 30 hours (for each paper)**

BZT101: Animal Diversity I

BZT102: Physiology

**Practical: 40 lectures: 32 hours**

BZP103: Animal Diversity I and Physiology

**B.Sc. – I Semester – II**

**Theory: 36 lectures: 30 hours (for each paper)**

BZT201: Cell Biology and Evolutionary Biology

BZT202: Genetics

**Practical: 40 lectures: 32 hours**

BZP203: Cell Biology and Evolutionary Biology and Genetics.

**B. Sc. Part-I Semester-I**

**BZT101: Paper I - ANIMAL DIVERSITY – I (Credits: 02)**

**Course Objectives:**

**Students should:**

1. Student should able to explain classification.
2. Student should able to define various terms.
3. Student should able to draw various figures.
4. Student should able to summarize what they learn.

**UNIT 1:**

**Kingdom - Protista (5)**

General characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa.

**Phylum - Porifera (4)**

General characters and classification up to classes; Canal system in *Sycon*

**Unit II**

**Phylum - Cnidaria (3)**

General characters and classification up to classes; Polymorphism in Hydrozoa

**Phylum - Platyhelminthes (6)**

General characters and classification up to classes; Life history of *Taenia solium* and its parasitic Adaptations

**UNIT III**

**Phylum - Nematelminthes (4)**

General characters and classification up to classes; Life history of *Ascaris lumbricoides* and its parasitic adaptations.

**Phylum - Arthropoda (5)**

General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in insects.

#### **Unit IV**

##### **Phylum - Annelida (2)**

General characters and classification up to classes; Metamerism in Annelida

##### **Phylum– Mollusca (2)**

General characters and classification up to classes; Torsion in gastropods

##### **Phylum– Echinodermata (2)**

General characters and classification up to classes; Water vascular system in Asteroidea

##### **Organic Farming– (3 )**

Organic waste, Types of Earthworm, Preparation of Vermicompost bed, Preparation of vermiwash.

#### **Learning Outcomes:**

1. Student should be able to get knowledge about diversity of all animal phyla
2. Student should be able to know about unicellular animal their locomotion.
3. Student can know about adaptation of animals.
4. Student can know about disease caused by parasitic animals and their control measures.

#### **Suggested Readings**

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. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution .IV Edition , Jones and Barlett publishers Inc.
4. R.L. Kotpal. *Invertebrate Zoology* 10<sup>th</sup> Edition.
5. Dhami. *Invertebrate Zoology* 10<sup>th</sup> Edition.
6. E.L. Jordan. *Invertebrate Zoology* 12<sup>th</sup> Edition.

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## **BZT101: Paper II - PHYSIOLOGY (Credits: 02)**

### **Course Objectives:**

#### **Students should:**

1. Student should able to learn various physiological processes.
2. Student should able to define various terms of physiology
3. Student should able to draw various figures.
4. Student should able to summarize what he learns.

### **Unit I**

#### **Nerve and muscle (9)**

Structure of a neuron, Resting membrane potential, Origin of Action potential and its propagation in non- myelinated nerve fibers, Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction.

### **Unit II**

#### **Digestion (9)**

Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids

### **Unit III**

#### **Respiration (4)**

Pulmonary ventilation, Transport of oxygen and carbon dioxide in blood

#### **Excretion**

**(5)**

Structure of nephron, Mechanism of urine formation, Counter – current Mechanism

## **Unit IV**

### **Cardiovascular system (6)**

Composition of blood, Structure of heart, origin and conduction of the cardiac impulse, Cardiac cycle

### **Blood Pressure (2)**

Measurement of systolic & diastolic pressure, cardiac output

### **ECG measurement (1)**

Physiological measurement & significance

#### **Learning Outcomes:**

1. Student will gain knowledge about animal physiology.
2. The students will be able to understand process of digestion, respiration and excretion.
3. Students able to understand special assessment techniques which may be used in the physical examination of the cardiovascular system, including blood pressure and electrocardiogram (ECG).
4. Students will be able to understand cardiac disorders, abnormality in blood pressure and ECG.

#### **Suggested Readings :**

1. Young, J.Z. (2004). *The Life of Vertebrates*, III Edition. Oxford university press.
2. Pough, H. *Vertebrate life*, VIII Edition, Pearson International.
3. Hall B.K. and Hallgrímsson B. (2008). *Strickberger's Evolution*. IV Edition, Jones and Barlett publishers Inc.
4. Tortora, G.J. and Derrickson, B.H. (2009). *Principles of Anatomy and Physiology*, XI Edition, John Wiley & Sons, Inc.
5. Widmaier, E.P., Raff, H. and Strang, K.T. (2008) *Vander's Human Physiology*, XI Edition, Mc GrawHill
6. Guyton, A.C. and Hall, J.E. (2011). *Textbook of Medical Physiology*, XII Edition, Harcourt Asia Pvt .Ltd /W.B. Saunders Company

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## Practical: BZP103 Practical I

### Learning Objectives:

1. Student should be able to know scientific terms, concepts, facts, phenomena & their interrelationships.
2. Student should be able to define, explain scientific methods, collection of scientific data.
3. Student should be able to know physiological measurement related to body.
4. Student should be able to summarize what he learns.

### 1. Study of the following specimens:

- i. Study of *Amoeba*, *Euglena*, *Plasmodium*, *Paramecium*, w.r.t. classification and locomotion
- ii. Study of *Sycon*, *Hyalonema* and *Euplectella*, *Obelia*, *Physalia*, *Aurelia*, *Tubipora*, *Metridium*, *Taenia solium*, Male and female *Ascaris lumbricoides*, *Aphrodite*, *Nereis*, *Pheretima*, *Hirudinaria*, *Palaemon*, *Cancer*, *Limulus*, *Palaemon*, *Scolopendra*, *Julus*, *Periplaneta*, *Apis*, *Chiton*, *Dentalium*, *Pila*, *Unio*, *Loligo*, *Sepia*, *Octopus*, *Pentaceros*, *Ophiura*, *Echinus*, *Cucumaria* and *Antedon*, w.r.t. classification and morphological peculiarities.

### 2. Study of the following:

- i. T.S. and L.S. of *Sycon*,
- ii. Life history *Taenia* and *Ascaris* and their parasitic adaptations.

### 3. Preparations of hemin and hemochromogen crystals.

### 4. Study Tour: Visit to Natural History Museum and submission of report.

### 5. Measurement of Blood Pressure by Sphygmomanometer.

### 6. Recording of ECG.

### Learning Outcomes:

1. Students able to describe unique character of each phylum.
2. Students are able to know animals with different phyla, their distribution and their relationship with the environment.
3. Students are able to develop practical skill in various hematological practical.
4. Students understand importance of health and hygiene.
5. Students able to know difference of bloods of different species depending upon the shape of the crystal.



## **Books Recommended**

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).
  - a. *The Invertebrates: A New Synthesis* , III Edition , Blackwell Science
3. Young , J.Z.(2004).*The Life of Vertebrates* , III Edition. Oxford university press.
4. PoughH .*Vertebrate life* , VIII Edition , Pearson International.
5. Hall B.K. and Hallgrimsson B. (2008). Strickberger'sEvolution .IV Edition ,  
Jones and Barlett publishers Inc.
6. Practical Zoology by Kotpal.
7. Practical Zoology by Verma & Agarwal.

**BZT201: Paper III - CELL BIOLOGY, EVOLUTIONARY BIOLOGY (Credits: 02)**

**Learning Objectives:**

1. Student should able to learn about cells and cell organelles.
2. Student should able to define various terms.
3. Student should able to draw various figures
4. Student should able to summarize what they learn.

**Unit I:**

**Cell Structure (4)**

Cell theory and diversity in cell size and shape

**Structure of Nucleus (2)**

Nucleus with reference to Nuclear Membrane, Nucleoplasma, Chromatin and nucleolus.

**Structure of Chromosome (3)**

With reference to morphology and organization (Nulceosome), Polytene Chromosome

**Unit II:**

**Ultra Structure and Functions of the following (6)**

- Plasma Membrane (Fluid Mosaic Model)
- Mitochondria
- Endoplasmic reticulum
- Golgi Complex
- Lysosome

**Diseases related chromosomes abnormality (3)**

**Sex linked-Klinefelter's**, and **Turner's Syndrome**, **Autosomal Diseases** – **Down's**, **Edward's** and **Patau's Syndrome**.

**UNIT III:**

**History of Life (3)**

Major Events in History of Life

**Introduction to Evolutionary Theories (6)**

Lamarckism, Darwinism, Neo- Darwinism

## **UNIT IV:**

### **Direct Evidences of Evolution (4)**

Types of fossils, Incompleteness of fossil record, dating of fossils

### **Extinction (5)**

Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of Extinction in evolution

### **Learning Outcomes:**

1. Student will gain knowledge about cell and cell organelle.
2. The students will be able to understand structure of nucleus and chromosome.
3. Students will know about the ultra structure of cell organelle and their functions.
4. Students will be able to understand diseases related to chromosomes and their abnormality.
5. Students will be able to understand evolution theories and role of extinction in evolution.

### **Suggested Readings :**

1. De Robertis EDP and De Robertis EME – Cell and Molecular Biology
2. C.B. Powar – Cell biology , Himalaya Pub.House
3. Cell biology –Dr. N.Arumugam
4. P. S. Verma & V. K. Agarwal-Cell biology , genetics , molecular biology
5. Evolution and Ecology
6. R.P. Meyyan , N , Arumugam – Genetics & Evolution
7. P.K. Gupta – Cell and Molecular Biology
8. Ridley, M.(2004), Evolution, III Edition , Blackwell Publishing
9. Barton , N.H. Briggs , D.E.G., Eisen , J.A. , Goldstein ,D.B. and Patel ,N.H.(2007).Evolution. Cold spring ,Harbour Laboratory Press.
10. Hall, B. K. and Hallgrimsson ,B.( 2008). Evolution .IV Edition ,Jones and Bartlett Publishers
11. Campbell, N. A. and Reece J. B. (2011), Biology, IX Edition, Pearson, Benjamin, Cummings.

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## **BZT202: Paper IV – GENETICS (Credits: 02)**

### **Learning Objectives:**

1. The student will gain a basic understanding on human genetics and hereditary.
2. Student should able to define various terms of Genetics.
3. Students can apply to real life situations and one's life the principles of human heredity.
4. They learn about chromosomal aberrations and its consequences.

### **UNIT I:**

#### **Introduction to Genetics (1)**

Mendel's work on transmission of traits, Genetic variation, Molecular basis of Genetic information. Mendelian and post Mendelian Genetics (8)

Principles of Inheritance, Incomplete dominance and co-dominance, gene interaction, Multiple alleles w.r.t. ABO, Rh blood groups and coat colour in rabbit.

### **UNIT II**

#### **Linkage, Crossing over (9)**

Linkage and process of crossing over, Coupling and repulsion theory, Cytological evidences of crossing over.

### **UNIT III: Mutations (6)**

Chromosomal mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and polyploidy, induced gene mutation. Genetic Counseling, Importance, Premarital Genetic Counseling. (3)

### **UNIT IV: Sex Determination (9)**

Chromosomal theory of sex determination e.g. Insects, Sex linked inheritance- Colorblindness and Haemophilia.

### **Learning Outcomes:**

1. Students will understand Mendelian genetics, their principles and gene interaction.
2. Students will be able to Apply the principles of Rh blood groups.
3. Students will Describe Genetic linkage.
4. Understanding the stochastic nature of crossing over
5. Students can identify and describes various chromosomal mutations.
6. Interpret the clinical implications of genetic disorders.

### **Suggested Readings**

1. Verma P.S.and Agarwal V .K. – Genetics , S. Chand and company
2. Strick berger – Genetics . C Millian publications
3. Winchester –Genetics Oxford publication
4. Genetics by P. P. Meyyam
5. P. S. Verma & V. K. Agarwal-Cell biology , genetics , molecularbiology
6. R.P. Meyyan , N , Arumugam – Genetics & Evolution
7. Gardner , E.J., Simmons , M.J., Snustad , D.P.(2008), Principles of Genetics , VIII Edition, Wiley India.
8. Snustad, D.P. Simmons, M.J. (2009), ‘Principles of Genetics’, V Edition , John Wiley and Sons Inc.
9. Klug , W .S ., Cummings , M.R. Spencer ,C.A.(2012),Concepts of Genetics. X Edition , Benjamin Cummings.
10. Russell , P.J.(2009), Genetics A Molecular Approach III Edition. Benjamin cummings.
11. Griffiths , A.J.F. , Wessler , S.R. Lewontin , R.C. and Carroll , S.B. introduction to Genetic Analysis. IX Edition , W.H. Freeman and Co.

## **Practical II: BZP203 (credits: 02)**

### **Learning Objectives:**

1. The student will gain a basic knowledge of Blood groupings and applications.
2. Student should be able to learn Mendelian Inheritance and post Mendelian modifications.
3. Students can co-relate human genetics with real life situations.
4. They learn about fossil evidences.

### **1. Identification of ABO and Rh blood groups.**

### **2. Cytological Preparations:**

Mitochondria – Stained preparation of mitochondria from onion peeling / Hydrilla leaf / Oral mucosa by using Janus Green B .

Polytene Chromosome – Stained preparation of Polytene chromosome larva / Drosophila larva.

### **3. Study of fossil evidences from plaster cast models and pictures.**

### **4. Darwin's Finches with diagrams / cut outs of beaks of different species.**

**5. Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using suitable examples. Verify the results using Chi – square test , Study of Linkage , recombination, gene mapping using the data (minimum 10 Examples on Mono , Dihybrid ratio , Incomplete dominance, Co- dominance , Multiple alleles , Sex linked inheritance , Linkage and crossing over and Gene interaction).**

### **6. Study of Human Karyotypes.**

### **7. Study of Human Genetic traits (any five)**

### **Learning Outcomes:**

1. Students able to develop practical skill.
2. Students able to solve various genetic examples.
3. Students able to understand Human Genetic traits.
4. Students able to understand importance of blood group.
5. Students able to know process of evolution.
6. Students able to form various plaster cast model and know their importance in fossil evidences.

## Books Recommended

8. Ruppert and Barnes , R. D. (2006) , *Invertebrate Zoology* ,VIII Edition .  
Holt Saunders International Edition.
9. Barnes, R.S.K. ,Calow , P., Olive, P.J.W. , Golding ,D. W. and Spicer , J.I.(2002).
  - a. *The Invertebrates: A New Synthesis* , III Edition , Blackwell Science
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11. PoughH .*Vertebrate life* , VIII Edition , Pearson International.
12. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution .IV Edition ,  
Jones and Barlett publishers Inc.
13. Practical Zoology by Kotpal.
14. Practical Zoology by Verma & Agarwal.