



**ST. XAVIER'S COLLEGE
(AUTONOMOUS), AHMEDABAD
(Affiliated to Gujarat University)**

CHOICE BASED CREDIT SYSTEM

**B. Sc. ZOOLOGY SYLLABUS
SEMESTER - II**

B.Sc. ZOOLOGY

PROGRAMME SPECIFIC OUTCOMES

- PSO1 Build a reliable foundation of all allied subjects of Zoology, besides classical Zoology itself.
- PSO2 Link Zoology to various fields in real life, viz., Parasitology, Entomology, Fisheries, Poultry Science, etc.
- PSO3 Student will be able to recognize and appreciate the plethora of fields into which he/she can progress onto, after graduation, viz., Biochemistry, Biotechnology, Bioinformatics, Toxicology, Food & Nutrition, Agriculture, Ethology, Parasitology, Environmental Science, Wildlife, Fisheries, Entomology, etc.
- PSO4 With the fundamental knowledge of applied Zoology subjects like Poultry Science, Sericulture, Apiculture, Fishery Science, Wildlife, etc., a zoology student can develop a STARTUP of their own.
- PSO5 Create employability, skill development and entrepreneurship.

B. Sc. ZOOLOGY SEMESTER- 2 SYLLABUS
(course effective from June - 2023)

1 credit in Theory equals to 1 hour of teaching per week in a semester.
1 credit in practical equals to 2 hours of teaching per week in a semester.

Pattern of Examination:

Examination	Duration	External Marks	Internal Marks	Total Marks
Theory-Paper ZO- 2501 (Core_1) (Basics of Zoology – II) [HUMAN BLOOD PHYSIOLOGY, NONCHORDATA & EVOLUTION, CYTOLOGY and GENETICS] (Theory ; 4 credits)	3 hours	50	50	100
Practical-Paper ZO- 2502L (Core_2) (Basics of Zoology Practicals - II) [Based on Theory Paper ZO- 2501] (Practicals ; 4 credits)	5 hours	50	50	100
Theory-Paper ZO- 2101 (Minor_1) (Fundamentals of Zoology – II) [HUMAN BLOOD PHYSIOLOGY, NONCHORDATA & EVOLUTION] (Theory ; 2 credits)	2 hours	25	25	50
Practical-Paper ZO- 2102L (Minor_2) (Fundamentals of Zoology Practicals - II) [Based on Theory Paper ZO- 2101] (Practicals ; 2 credits)	3 hours	25	25	50
Theory-Paper ZO- 2351 Multidisciplinary course [Animal Diversity and Conservation] (Theory ; 4 credits)	3 hours	50	50	100
Theory-Paper ZO- 2650 Skill Enhancement course [Science and Economics of Sericulture] (Theory ; 2 credits)	2 hours	25	25	50

INSTRUCTIONS

1. The theory question paper comprises of FIVE / THREE questions. All questions carry equal marks, i.e. 10 marks in the final examinations.
2. In order to be qualified to appear in the Final Practical Examination, the student must submit his / her duly certified journal during the examinations.

ST. XAVIER'S COLLEGE (AUTONOMOUS), AHMEDABAD
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B.Sc. Semester-2 ZOOLOGY SYLLABUS
Choice based credit system (CBCS)
(course effective from June - 2023)

Discipline Specific Course [Core-1] : Basics of Zoology – II (Theory)

[HUMAN BLOOD PHYSIOLOGY, NONCHORDATA & EVOLUTION, CYTOLOGY and GENETICS]

CREDIT DISTRIBUTION AND ELIGIBILITY OF THE COURSE

Number of Credits	Course Title and Code	Credit Distribution of Course			Eligibility Criteria	Learning hours in semester
		Lecture	Tutorial	Practical		
4	Basics of Zoology- II (ZO-2501)	4 per week	0	0	10 + 2 pass from a recognized board with Biology subject	60

COURSE OUTCOMES (COs)

- CO1** study the structure and functions of Human blood
CO2 have profound knowledge of organic evolution as they will understand the process of origin of life and how variations and mutations are operated by natural selections.
CO3 Understand anatomy of Hydra as an animal type
CO4 continuing from what they have grasped about the basics of Cytology during their Sem-1, the students will progress further by studying some more advanced instruments like TEM, SEM and centrifuges along with some more organelles like Ribosomes, Mitochondria and Golgi complex.
CO5 study principles of Human genetics
CO6 understand Non-allelic gene interactions

Unit I HUMAN BLOOD PHYSIOLOGY

1. Functions of blood
2. Composition of blood
 - i) Blood Plasma- Water, Dissolved solids, Dissolved gases
 - ii) Blood cells-
 - a) RBC - Structure, Total count, Functions
 - Haemoglobin
 - Effect of isotonic, hypotonic and hypertonic solutions
 - Development & Life history
 - Factors affecting Erythropoiesis
 - Anaemia- General symptoms, Types: Nutritional, Pernicious, Haemorrhagic, Haemolytic, Aplastic and Sickle-cell
 - b) WBC - Structure, Total count, Functions
 - Classification
 - Development & Life history
 - A very brief concept of Leukaemia
 - c) Platelets - Structure, Total count, Functions, Development & Life history
3. Blood coagulation
 - i) Brief introduction and significance
 - ii) Factors involved in blood clotting
 - iii) Intrinsic & Extrinsic pathways of blood coagulation
 - iv) Basic concept of Intravascular blood clotting

4. Blood groups and Types:
Classification of blood groups
- ABO and Rh Blood Groups
- Transfusion

Unit II (A) ANIMAL DIVERSITY (Nonchordates) – Type study

Coelenterata: Animal study **Hydra**: Classification, Habitat & Habits, Morphology, Histology, Locomotion, Nutrition and Reproductive organs & Reproduction

(B) ORGANIC EVOLUTION

- a) Introduction
b) Chemical evolution & Spontaneous origin of life
- Oparin's theory of Coacervate droplets formation, Miller's experiment, Protoid microspheres
c) Theories of Organic Evolution:
- Lamarckism
- Darwinism

Unit III CYTOLOGY

- A) Structure & working of the TEM & SEM
B) Centrifugation: Introduction, Low speed centrifugation, Ultracentrifugation
C) Eukaryotic Ribosomes: Introduction and Occurrence, Types of Ribosomes (70S, 80S), Structure, Ultrastructure and general functions
D) Mitochondria: Introduction and Occurrence, Morphology (Shape, Size, Number), Ultrastructure and general functions, Mitochondrial DNA, Mitochondrial Ribosome
E) Golgi complex: Introduction and Occurrence, Morphology / Ultrastructure and General functions

Unit IV GENETICS

1. Complementary genes (*e.g.* Pea plant – purple & white flowers)
2. Non-epistatic gene interaction (*e.g.* comb shapes in chicken)
3. Duplicate genes (*e.g.* seedpods in Shepherd's purse plant)
4. Sex-linked inheritance:
- X-linked [dominant] (*e.g.* enamel of tooth in human)
- X-linked [recessive] (*e.g.* colour blindness & haemophilia in human, eye-colour in *Drosophila*)
- Y-linked genes (*e.g.* Hypertrichosis in man)
- XY-linked inheritance
- Completely and Incompletely sex-linked inheritance
5. Sex-influenced inheritance (*e.g.* Baldness in human)
6. Simple Mendelian traits in Human (*e.g.* Tasters and Non-tasters, Brown and Blue eye colours)
7. Genetics Examples (other than in practical syllabus)

Reference books for Unit I:

1. Principles of Anatomy & Physiology, Tortora and Grabowski, Harper Collins College Pub.
2. Animal Physiology and Related Biochemistry, H. R. Singh, Shobhan Lal Naginchand & Co. Edu. Pub., Jalandhar.
3. Textbook of Animal Physiology, A. K. Berry, Emkay Pub., New Delhi.

Reference books for Unit II:

1. Textbook of Invertebrates, R. L. Kotpal, Rastogi Publications, Meerut.
2. Manual of Zoology, Vol. 1 & 2, E. K. Ayer.
3. Invertebrate Zoology, Jordan and Verma, S. Chand & Company, Delhi.

Reference books for Unit III :

1. Cytology, P. S. Verma, S. Chand & Co. Ltd., New Delhi.
2. Cell Biology, C. B. Powar, Himalaya Pub. House.
3. Cell and Mol. Biol., E.D.P. DeRobertis and E.M.F. DeRobertis, Holt-Saunders, Japan.

Reference books for Genetics :

1. Genetics, P. K. Gupta, Rastogi Publications, Meerut.
2. Genetics, V. B. Rastogi, Kedarnath Ramnath, Meerut.
3. Genetics Vol. 1, C. B. Powar, Himalaya Pub. House.

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B.Sc. Semester-2 ZOOLOGY SYLLABUS
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(course effective from June - 2023)

Discipline Specific Course [Core-2] : Basics of Zoology Practicals - II

[HUMAN BLOOD PHYSIOLOGY, NONCHORDATA & EVOLUTION , CYTOLOGY and GENETICS]

CREDIT DISTRIBUTION AND ELIGIBILITY OF THE COURSE

Number of Credits	Course Title and Code	Credit Distribution of Course			Eligibility Criteria	Learning hours in semester
		Lecture	Tutorial	Practical		
4	Basics of Zoology Practicals - II (ZO-2502L)	0	0	4 per week	10 + 2 pass from a recognized board with Biology subject	120

COURSE OUTCOME (COs)

- CO1** learn practical aspects of Haematology
CO2 have profound knowledge of organic evolution as they will understand the process of origin of life and how variations and mutations are operated by natural selections.
CO3 practically understand various structural details of *Hydra* by observing it and its different parts under microscope.
CO4 Whatever the students have learnt about CYTOLOGY in theory, they will understand the same practically.
CO5 understand pattern of inheritance different from Mendelism
CO6 apply knowledge of genetics in problem solving

1. HUMAN BLOOD PHYSIOLOGY

- Preparation of a blood smear to identify various WBCs, using Leishman's stain
- Determination of ABO and Rh blood groups
- Demonstrate the effect of isotonic, hypotonic and hypertonic saline on RBCs
- Preparation of Haemin crystals

2. HYDRA

Study by permanent slides of :

- W.M. of *Hydra*
- W.M. of *Hydra* with gonads
- T.S. of *Hydra*
- L.S. of *Hydra*
- T.S. of *Hydra* passing through testis
- T.S. of *Hydra* passing through ovary
- Nematocyst of *Hydra*

3. ORGANIC EVOLUTION

Study by charts of :

1. Miller's experiment
2. Coacervates
3. Proteinoid microspheres
4. Lamarckism
5. Darwinism

4. CYTOLOGY

Study by charts of

1. TEM
2. SEM
3. Low speed centrifuge
4. Ultracentrifuge
5. Ultrastructure of Eukaryotic Ribosome, Mitochondrion and Golgi complex

5. GENETICS

A. Study by charts of :

1. Complementary genes (*e.g.* Pea plant – purple & white flowers)
2. Non-epistatic gene interaction (*e.g.* comb shapes in chicken)
3. Duplicate genes (*e.g.* seedpods in Shepherd's purse plant)
4. Sex-linked inheritance:
 - X-linked [dominant] (*e.g.* enamel of tooth in human)
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B. Study of genetic problems (as per APPENDIX)

APPENDIX for GENETIC PROBLEMS

1. Two white flowered varieties of pea (*Lathyrus*) plants when crossed produced purple flowered F_1 plants. Selfing of F_1 plants produced 112 progeny, 62 plants with purple flower and 50 with white flowers.
 - a) What type of interaction is involved?
 - b) Give a phenotype ratio approximated by the F_2 progeny.

Solution :

- a) Complementary gene action
- b) 9:7 ratio

2. If a heterozygous walnut combed chicken is mated with a single combed chicken, what will be the offsprings be like?

Solution :

- a) Genotype of walnut combed chicken: RrPp
b) Genotype of single combed chicken: rrpp

3. Rose combed chicken mated with walnut combed chicken produced 15 walnut, 14 rose, 5 pea and 6 single combed chicks. Determine probable genotypes of the parents.

Solution :

- a) Genotype of rose combed chicken: Rrpp
b) Genotype of walnut combed chicken: RrPp

4. Determine phenotypes in a cross between triangular seed capsule producing Shepherd's purse plant with the elongated one. Give genotypes and phenotypes of F₁ and F₂ progeny. Mention the type of gene interaction involved and the ratio observed in F₂ generation.

Solution :

- a) Genotype of Triangular seed capsule plant: TTDD
b) Genotype of Elongated seed capsule plant: ttdd
c) Duplicate genes, 15:1 ratio

5. From a marriage, all the daughters are normal sighted whereas all the sons are colourblind.

- a) Give genotypes of the parents.
b) If both the parents were colourblind, can they give rise to normal children?

Solution :

- a) Genotype of parents : Mother = X^cX^c (colourblind)
Father = XY (normal)
b) If both are colourblind, they cannot give rise to normal children.

6. A normal woman, whose father is haemophilic marries a normal man. Explain the possibility of haemophilia in children produced by them.

Solution :

- a) Genotype of parents : Mother = X^HX^h (carrier)
Father = XY (normal)
b) Genotypes of Children: Daughters = Non-haemophilic
Sons = Normal: Haemophilic (1:1)

7. A man has hypertrichosis which appears due to Y-linked gene. He marries a normal woman. State the possibilities of hypertrichosis in their children.

Solution :

- a) Genotype of parents : Mother = XX
Father = XY^t (hypertrichosis)
b) Genotypes of Children: Daughters = XX (all- normal)
Sons = XY^t (all- hypertrichosis)

8. Early baldness in man is due to an autosomal gene and is dominant in males. The homozygous recessive results in late baldness or non-baldness. If the heterozygous persons marry and beget children,

- a) What are the phenotypes of the male and female children?
- b) What will be the phenotypic ratio among the male children?
- c) What will be the phenotypic ratio among the female children?

Solution :

- a) Genotypes: Father- Bb
Mother- Bb
- b) Boys: = Bald : Normal = 3:1
- c) Girls: = Bald : Normal = 1:3

X-X-X-X-X

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Minor_1 Course : Fundamentals of Zoology – II (Theory)

[HUMAN BLOOD PHYSIOLOGY, NONCHORDATA & EVOLUTION]

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Histology, Locomotion, Nutrition and Reproductive organs & Reproduction

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Minor_2 Course : Fundamentals of Zoology Practicals– II

[HUMAN BLOOD PHYSIOLOGY, NONCHORDATA & EVOLUTION]

CREDIT DISTRIBUTION AND ELIGIBILITY OF THE COURSE

Number of Credits	Course Title and Code	Credit Distribution of Course			Eligibility Criteria	Learning hours in semester
		Lecture	Tutorial	Practical / Practice		
2	Fundamentals of Zoology practicals- II (ZO-2102L)	2 per week	0	0	10 + 2 pass from a recognized board with Biology subject	30

COURSE OUTCOME (COs)

- CO1** learn practical aspects of Haematology
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2. HYDRA

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- T.S. of *Hydra* passing through testis
- T.S. of *Hydra* passing through ovary
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3. ORGANIC EVOLUTION

Study by charts of :

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Skill Enhancement Course : Science and Economics of Sericulture (Theory)

CREDIT DISTRIBUTION AND ELIGIBILITY OF THE COURSE

Number of Credits	Course Title and Code	Credit Distribution of Course			Eligibility Criteria	Learning hours in semester
		Lecture	Tutorial	Practical		
2	Science and Economics of Sericulture (ZO-2651)	2 per week	0	0	10 + 2 pass from a recognized board with Biology subject	30

COURSE OUTCOMES (COs)

- CO1** This course aims to provide students with a comprehensive learning of the science behind sericulture, which incorporates the cultivation of silk-producing insects, silk production, silk processing, and post-harvest techniques
- CO2** Through this course, students will understand various aspects of sericulture and develop profound knowledge about the silk industry and related economics

Unit 1: Introduction to Sericulture

1. Overview of sericulture and its historical significance
2. Systemic position of silkworm
3. Introduction to silk-producing insects and life cycle of *Bombayx mori*
4. Understanding the different species of silkworm
5. Importance of sericulture in the economy and society

Unit 2: Cultivation of Silk-Producing Insects

1. Requirements for rearing of silkworms
2. Rearing appliances of Silkworm Rearing House
3. Moriculture
4. Grainage management
5. Supply of seeds to rearers and commercial rearing

Unit 3: Silk Production and Processing

1. Analysis of environmental factors affecting silkworm growth
2. Disease and pest control in sericulture
3. Analysis of silk processing methods (stifling, reeling and spinning)
4. Quality assessment of silk and grading tests
5. Chemistry of silk

Unit 4: Post-Harvest Techniques and Silk Industry

1. Silk dyeing and printing techniques
2. Applications of silk
3. Market analysis ,trade and economic dynamics of the silk industry
4. Central silk Board and its functioning
5. Various sericulture research and training institutes across India

Reference books / websites:

1. Economic Zoology, G. S. Shukla and V. B. Upadhyay, Rastogi Publications, Meerut.
2. Economic and Applied Entomology, Kumar and Nigam, Emkay Pub., Delhi.
3. https://agritech.tnau.ac.in/sericulture/seri_index.html
4. <https://silks.csb.gov.in/>

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Multidisciplinary Course : Animal Diversity and Conservation (Theory)

CREDIT DISTRIBUTION AND ELIGIBILITY OF THE COURSE

Number of Credits	Course Title and Code	Credit Distribution of Course			Eligibility Criteria	Learning hours in semester
		Lecture	Tutorial	Practical		
4	Animal Diversity and Conservation (ZO-2350)	4 per week	0	0	10 + 2 pass from a recognized board in science stream	60

COURSE OUTCOMES (COs)

- CO1** Understand basic concepts and distribution of Biodiversity
CO2 Importance and methods of biodiversity conservation
CO3 Legal aspects of Biodiversity conservation

Unit 1 Basic Concepts of Biodiversity

1. Introduction
2. Importance of Biodiversity
3. Biosphere Reserves- Concept, Objectives, Composition and importance of Biospherere reserves of India

Unit 2 Advanced Concepts of Biodiversity

1. Types of Biodiversity; Genetic, species and ecological biodiversity (Alpha, Beta and Gamma diversity)
2. Threats to biodiversity

3. In- situ and Ex -situ conservation of biodiversity

Unit 3 Distribution of Biodiversity in India

1. Bio geographic zones of India (ten zones)
2. Biological hotspots
3. Animal diversity of Gujarat with reference to Lion, Blackbuck, wild Ass, Great Indian Bustard and Sloth Bear

Unit 4 Conservation of Biodiversity:

1. Biological diversity Act 2002
2. Indian Board of Wildlife and its functioning
3. Gujarat Biodiversity Board and its activities
4. IUCN Red list categories
5. Project Tiger of India, Crocodile Breeding Project.

Reference books / suggested websites:

1. Ecology and Environment by P.D.Sharma, 12th Edition, Rastogi Publication, Meerut.
2. Textbook of Environmental Studies by Erach Bharucha published by UGC, University press.
3. <http://gsbb.gujarat.gov.in>
