



ST. XAVIER'S COLLEGE (AUTONOMOUS), AHMEDABAD

CHOICE BASED CREDIT SYSTEM

B. Sc. ZOOLOGY SYLLABUS

(SEMESTER - I)

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- 1 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- 1501 (Core_1) (Basics of Zoology – I) [HUMAN RENAL PHYSIOLOGY, NONCHORDATA, CYTOLOGY and GENETICS] (Theory ; 4 credits)	3 hours	50	50	100
Practical-Paper ZO- 1502L (Core_2) (Basics of Zoology Practicals - I) [Based on Theory Paper ZO- 1501] (Practicals ; 4 credits)	5 hours	50	50	100
Theory-Paper ZO- 1101 (Minor_1) (Fundamentals of Zoology – I) [CYTOLOGY and GENETICS] (Theory ; 2 credits)	2 hours	25	25	50
Practical-Paper ZO- 1102L (Minor_2) (Fundamentals of Zoology Practicals - I) [Based on Theory Paper ZO- 1101] (Practicals ; 2 credits)	3 hours	25	25	50
Theory-Paper ZO- 1351 Multidisciplinary course [Basic concepts of Ecology] (Theory ; 4 credits)	3 hours	50	50	100
Theory-Paper ZO- 1650 Skill Enhancement course [Science and Economics of Apiculture] (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
(Affiliated to Gujarat University)
B.Sc. Semester-1 ZOOLOGY SYLLABUS
Choice based credit system (CBCS)
(course effective from June - 2023)

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

[HUMAN RENAL PHYSIOLOGY, NONCHORDATA, 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- I (ZO-1501)	4 per week	0	0	10 + 2 pass from a recognized board with Biology subject	60

COURSE OUTCOMES (COs)

- CO1** Understand structure and functions of Human kidneys
CO2 Understand single celled animals and their habits with special reference to Amoeba
CO3 Grasp the basics of cytology, starting with most basic instruments like Light microscopes, the ultrastructure and diversity of typical animal cell and couple of important cell organelles
CO4 Study structure of gene and related terminology
CO5 explain and apply basic principles of genetics and its derivatives

Unit 1 Structure and Functions of Human Kidneys

A) Anatomy of kidneys:

1. Location
2. Gross anatomy
3. V. S. of human kidney
4. The Nephron :
 - Basic structure and parts of nephron
 - Ultrastructure of nephron

B) Renal Physiology:

Physiology of urine formation :

- a) Glomerular filtration / Ultrafiltration :
 - Filtration membrane
 - Net Filtration pressure
 - Glomerular filtration rate
- b) Tubular reabsorption & Secretion :
 - Reabsorption and Secretion in the Proximal Convoluted Tubule
 - Reabsorption in Loop of Henle
 - Reabsorption and Secretion in the Collecting Duct

C) Characteristics of Urine

1. Physical characteristics of normal urine:

- | | |
|---------------|---------------------|
| a) Volume | d) Odour |
| b) Appearance | e) pH |
| c) Turbidity | f) Specific gravity |

2. Chemical composition of normal urine:

- | | |
|-----------------|---------------|
| a) Water | d) Uric acid |
| b) Electrolytes | e) Creatinine |
| c) Urea | |

3. Physical characteristics of abnormal urine:

- | | |
|---------------------|---------------------------|
| a) Appearance | d) pH |
| b) Odour | e) Blood and tissue cells |
| c) Specific gravity | f) Casts |

4. Abnormal constituents of urine:

- | | |
|------------------|--------------------|
| a) Protein | g) Urobilinogen |
| b) Carbohydrates | h) Acetone |
| c) Fat | i) Pus |
| d) Ketone bodies | j) Urinary calculi |
| e) RBC and WBC | k) Microbes |
| f) Bilirubin | |

Unit II NONCHORDATA – Type study & General topics

A) General structure & morphology with functional anatomy of the following animal :

Protozoa: Type study– **Amoeba proteus** : Systematic position, Habits & Habitat, Structure, Locomotion(Sol-Gel Theory), Nutrition, Reproduction (Binary fission, Multiple fission)

B) General topics :

Protozoa : Protozoan Diseases; Leishmaniasis, Trypanosomiasis, Giardiasis, Cryptosporidiosis, Toxoplasmosis

Porifera : Economic importance, Modes of asexual reproduction in sponges (Budding, Fission, Reduction bodies, Gemmules).

Unit III CYTOLOGY

A) Microscopes :

Structure, Principle & working of the following student's light microscopes:

- Simple light microscope
- Monocular Compound light microscope

B) (i) Ultrastructure of a typical animal cell

(ii) Diversity in Eukaryotic cells - shape & size

C) Cytoplasm:

- a) Physical nature of matrix
- b) Chemical organization of matrix
 - Chemical elements
 - Atom
 - Compounds and Molecules
 - Electrolytes & Non-electrolytes
 - Acids, Bases and Salts

D) Nucleus :

- Introduction, Occurrence and position
- Ultrastructure and general functions

E) Endoplasmic Reticulum(ER) :

- Introduction and Occurrence
- Morphology (Cisternae, Vesicles, Tubules)
- Types of ER (rough and smooth)
- General functions

Unit IV GENETICS

1. Brief introduction to Gene and Genetic terminology
2. Mendelism & Laws of Heredity
3. Incomplete Dominance (e.g. *Mirabilis jalapa*)
4. Co-dominance (e.g. Roan cattles, Andalusian fowl)
5. Multiple alleles (e.g. coat colour in rabbit, ABO blood groups in human)
6. Polygenic inheritance (e.g. skin colour in human)
7. Lethal genes (e.g. yellow coat colour in mice, sickle cell anaemia)
8. Epistasis- Dominant (e.g. coat colour in dogs), Recessive (e.g. coat colour in mice)
9. Genetic examples (other than in practical syllabus)

Reference books for Unit I:

1. **Principles of Anatomy & Physiology**, Tortora and Gabrowski, Harper Collins College Publications.
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. De Robertis and E.M.F. De Robertis, Holt-Saunders, Japan.

Reference books for Unit IV:

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.
4. **Genetics**, R. P. Meyyan, Saras Publication, Nagercoil

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B.Sc. Semester-1 ZOOLOGY SYLLABUS
Choice based credit system (CBCS)
(course effective from June - 2023)

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

[HUMAN RENAL PHYSIOLOGY, NONCHORDATA, 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 - I (ZO-1502L)	0	0	4 per week	10 + 2 pass from a recognized board with Biology subject	60

COURSE OUTCOMES (COs)

- CO1** learn urine analysis by performing biochemical tests
- CO2** learn Anatomy of Amoeba and its habits so as to get general idea of protozoans
- CO3** Whatever the students have learnt about CYTOLOGY in theory, they will understand the same practically
- CO4** understand Mendelian pattern of inheritance and its deviations
- CO5** apply knowledge of genetics in problem solving

1. HUMAN URINE ANALYSIS

A) Physical analysis :

- Colour appearance, odour, deposits if any.
- Determination of pH and Specific gravity

B) Chemical analysis :

- a) Detection of abnormal constituents in urine: Sugar, Proteins, Bile salts. Ketones (Rothera's test), Urea (using soyabean powder) and Creatinine (Jaffe's test).
- Detection of gluCOse by kit method

2. HUMAN URINARY SYSTEM

Study by permanent slides/charts of :

- a) V.S. of kidney.

- b) Renal corpuscle.
- c) Juxta glomerular apparatus

3. AMOEBA

Study by permanent slides/charts of :

- a) W.M. of Amoeba
- b) Binary fission

4. NONCHORDATES

Study by charts of:

Pathogenic protozoans a) Leishmania b) Trypanosoma c) Giardia d) Cryptosporidium e) Toxoplasma
Porifera : Modes of asexual reproduction: Budding, Fission, Reduction bodies, Gemmules

5. CYTOLOGY :

Study of by charts/models of :

- a) Simple light microscope and Monocular Compound light microscope
- b) Diversity in eukaryotic cell-shape & size
- c) Ultrastructure of :
 - Typical animal cell
 - Physical nature of cytoplasm
 - Nucleus
 - Endoplasmic Reticulum
- d) Temporary slide preparations of :
 - 1. Human cheek epithelial cells using methylene blue stain
 - 2. Onion peel cells using iodine stain
- e) Setting up of simple and compound light microscopes

6. GENETICS :

A) Study by charts of :

- 1. Monohybrid cross
- 2. Dihybrid cross
- 3. Incomplete Dominance (e.g. *Mirabilis jalapa*)
- 4. Co-dominance (e.g. roan cattles, Andalusian fowl)
- 5. Multiple alleles (e.g. coat colour in rabbit, ABO blood groups in human)
- 6. Polygenic inheritance (e.g. skin colour in human)
- 7. Lethal genes (e.g. yellow coat colour in mice, Sickle cell anaemia)
- 8. Epistasis- i) Dominant epistasis in dogs ii) Recessive epistasis in mice

B) Study of genetic problems (as per APPENDIX-I)

Appendix I GENETIC PROBLEMS PAPER – ZO 1502L
(effective from June-2023 onwards)

1. Red fruit colour (R) is dominant over yellow (r) and tallness (T) is dominant over shortness (t) in plants. What phenotypic ratio & genotypes would result if one of the plants is red homozygous-tall homozygous and other is red heterozygous- tall heterozygous?

Solution :

Phenotypic ratio = All phenotypes in equal proportion

Genotypes = RRTT, RRTt, RrTT, RrTt

2. In rabbits, black skin (B) is dominant over brown skin (b) and short hair (S) is dominant over long hair (s). If homozygous black-short haired male is crossed with a homozygous brown-long haired female, what will be the genotypes and phenotypes of F₁ and F₂ offsprings?

Solution :

F₁ = BbSs = all black-short haired

F₂ = 9:3:3:1

3. In four o'clock plants, red colour of flowers (R) is incompletely dominant over white (r). The F₁ offsprings are having pink flower colour (Rr). What will be phenotypes of the offsprings in a cross between plants of red flowers and pink flowers?

Solution :

Red : Pink = 1:1

4. A roan bull is bred to three cows. Cow A has the same genotype as the roan bull. Cow B is red and cow C is white. What proportions of roan cows are expected in the offsprings of any one group of cows?

Solution :

Roan bull X Roan cow = 1 red : 2 roan : 1 white

Roan bull X Red cow = 1 red : 1 roan

Roan bull X White cow = 1 roan : 1 white

5. A couple preparing for marriage, both have blood group AB. They ask you what type of blood groups their children may have. What would you tell them and how would you explain your conclusions?

Solution :

Blood group of children can be A, AB or B.

6. A man has blood group A and his wife has blood group B. They have four children, all having different blood groups i.e. A, B, AB and O. Is it possible? How?

Solution :

Yes, it is possible, if both the parents are Heterozygous

7. In man, the difference in skin colour between whites and negroes is due to two pairs of factors, A^AB^B is "black" and a^ab^b is "white". Any three of the colour producing factors produce dark skin, any two medium and any one light colour. What will be the skin colour of the offspring from a mating of white with black and from a mating of two F₁ individuals?

Solution :

Parents genotype = aabb X AABB

F₁ offsprings skin colour = medium

F₂ = 1:4:6:4:1 (black : dark : medium : light : white)

8. When dogs from a true breeding brown coat line were mated to dogs from a true breeding white coat line, all the F₁ progeny were white coat colour. Male and female mating of F₁ progeny produced F₂ progeny in the ratio of 130 white : 35 black : 11 brown. Explain these results.

Solution :

130:35:11 = 12:3:1 Dominant epistasis

9. Mating between two agouti mice of the same genotype produced offsprings in the ratio of 45 agouti : 15 black : 19 albino.
- Give the approximate phenotype ratio of these offsprings.
 - Give the type of interaction between the non-allelic genes responsible for the ratio calculated in (a).
 - Give the genotype of the parents and offsprings.

Solution :

a) 9:3:4

b) Recessive epistasis

c) CcAa, CcAa

X-X-X-X-X

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Minor_1 Course : Fundamentals of Zoology – I (Theory)

(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		
2	Fundamentals of Zoology- I (ZO-1101)	2 Per week	0	0	10 + 2 pass from a recognized board with Biology subject	30

COURSE OUTCOMES (COs)

- CO1** Grasp the basics of cytology, starting with most basic instruments like Light microscopes, the ultrastructure and diversity of typical animal cell and couple of important cell organelles
- CO2** Study structure of gene and related terminology
- CO3** explain and apply basic principles of genetics and its derivatives

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D) Nucleus :

- Introduction, Occurrence and position
- Ultrastructure and general functions

E) Endoplasmic Reticulum(ER) :

- Introduction and Occurrence
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Unit II GENETICS

1. Brief introduction to Gene and Genetic terminology
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3. Incomplete Dominance (e.g. *Mirabilis jalapa*)
4. Co-dominance (e.g. Roan cattles, Andalusian fowl)
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9. Genetic examples (other than in practical syllabus)

Reference books for Unit I:

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2. Cell Biology, C. B. Powar, Himalaya Pub. House.
3. Cell and Mol. Biol., E.D.P. De Robertis and E.M.F. De Robertis, Holt-Saunders, Japan.

Reference books for Unit II:

1. Genetics, P. K. Gupta, Rastogi Publications, Meerut.
2. Genetics, V. B. Rastogi, Kedarnath Ramnath, Meerut.
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Minor_2 Course : Fundamentals of Zoology Practicals – I
(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		
2	Fundamentals of Zoology Practicals- I (ZO-1102L)	0	0	2 per week	10 + 2 pass from a recognized board with Biology subject	60

COURSE OUTCOMES (COs)

CO1 Whatever the students have learnt about CYTOLOGY in theory, they will understand the same practically

CO2 understand Mendelian pattern of inheritance and its deviations

CO3 apply knowledge of genetics in problem solving

1. CYTOLOGY :

Study of by charts/models of :

- a) Simple light microscope and Monocular Compound light microscope
- b) Diversity in eukaryotic cell-shape & size
- c) Ultrastructure of :
 - Typical animal cell
 - Physical nature of cytoplasm
 - Nucleus
 - Endoplasmic Reticulum
- d) Temporary slide preparations of :
 1. Human buccal epithelial cells using methylene blue stain
 2. Onion peel cells using iodine stain
- e) Setting up of simple and compound light microscopes

2. GENETICS :

A) Study by charts of :

1. Monohybrid cross
2. Dihybrid cross
3. Incomplete Dominance (e.g. *Mirabilis jalapa*)
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8. Epistasis- i) Dominant epistasis in dogs
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B) Study of genetic problems (as per APPENDIX-I)

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B.Sc. Semester-1 ZOOLOGY SYLLABUS

Choice based credit system (CBCS)

(course effective from June - 2023)

Skill Enhancement Course : Science and Economics of Apiculture (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 Apiculture (ZO-1651)	2 per week	0	0	10 + 2 pass from a recognized board with Biology subject	30

COURSE OUTCOMES (COs)

- CO1** understand structure, life cycle and behaviour of Honey bees
CO2 learn principles and skills of honey bees culture
CO3 study commercial aspects of honey production

Unit 1: Biological Aspects of Apiculture

1. Classification of Honey bees
2. Different species of Honey bees
3. Life cycle of a Honey bee
4. Dance language of Honey bees

Unit 2 Biological Aspects of Apiculture

1. Characteristics of Flora for Apiculture
2. Characteristics of Fauna for Apiculture
3. Casts of Honey bee
4. Typical natural bee hive
5. Artificial bee hive

Unit 3: Economical Aspect of apiculture

1. History of Bee rearing
2. Economics of Apiculture
3. Recent trends in Apiculture
4. Setting up an Apiary: Steps and factors to be considered
5. Apiculture products: Honey, Bees wax and Royal Jelly
6. Apiculture kit

Unit 4 Production of Honey:

1. Indigenous methods of honey extraction
2. Modern methods of honey extraction
3. Chemistry of pure honey
4. Purity tests for honey
5. Visit to an Apiary / Case study of an apiary
6. Institutes / Training programme for running apiary
7. Various Bee diseases to be controlled for better yield

Reference book: 1. **Economic Zoology-** By Shukla and Upadhyay

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B.Sc. Semester-1 ZOOLOGY SYLLABUS
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Multidisciplinary Course : Basic concepts of Ecology (*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	Basic concepts of Ecology (ZO-1350)	4 per week	0	0	10 + 2 pass from a recognized board in science stream	60

CO1 study basic concepts of ecosystems

CO2 understand interrelationships of abiotic and biotic components of environment

CO3 know about flow of energy in ecosystems

Unit 1 Introduction and factors of ecosystem

1. Definition and basic concept
2. Structure of ecosystem:
 - Abiotic factors- Soil, Water, Light, Air, Temperature
 - Biotic factors- Producers, Consumers, Decomposers

Unit 2 Functions of Ecosystem:

1. Food chains- Grazing and Detritus types
2. Food webs
3. Ecological pyramids of - Numbers, Biomass, Energy
4. Energy flow- Primary, Secondary and Tertiary consumers

Unit 3 Animal relationships:

- Mutualism, Commensalism, Competition, Predation, Parasitism

Unit 4 Biogeochemical cycles:

1. Carbon cycle
2. Nitrogen cycle
3. Oxygen cycle
4. Water cycle

Reference books:

1. **Concepts of Ecology**, R. L. Kotpal and N. P. Bali, Vishal Publication, Punjab.
2. **Ecology and Environment**, P. D. Sharma, Rastogi Publication, Meerut.
3. **Concepts of Ecology and Environmental Biology**, N. Arumugam, Saras Publication, Nagercoil.
4. **Ecology**, **M. P. Arora**, Himalaya Publication, Mumbai.
