



SOMAIYA
VIDYAVIHAR

K J Somaiya College of Science & Commerce

Department: Zoology

Somaiya

TRUST

F. Y. B.Sc. Syllabus

KJ Somaiya College of Science & Commerce
Autonomous (Affiliated to Mumbai University)
Vidyavihar

Mumbai-400077

Department of Zoology

Syllabus

for

F.Y.B.Sc.

(to be implemented from 2018 - 2019)



Preamble

The syllabus of F.Y.B.Sc. Zoology was revised this year [BOS held on 22.8.2017] and will be effective from the academic year 2018-19. It has been modified keeping in mind the capabilities and requirements of the present students.

The syllabus includes basic as well as some advanced concepts of zoology, which will gradually be built up from first year to third year, to give the student a well-rounded grasp over the subject. Topics related to fundamentals of Zoology such as Animal Diversity, Ecology and Ethology are covered along with applied topics like Introduction to Biochemistry and Genetics. Reflecting the changing demands of the job market, subjects such as Biotechnology is also included. The practical aspect of each core subject is designed to equip the student with skills required for animal identification, description, life process studies and basic estimations.

Thus, the syllabus revision aims at striking a balance between classical and advanced Zoology, thereby empowering the student to not only gain knowledge but also skills required to secure a good career in Zoology.



Learning objectives and outcomes

- To inculcate basic concepts of classical and applied zoology in minds of learners
- To make the learner aware of recent trends in zoology
- To give the learner an opportunity to experience first-hand field work and biodiversity by organising visits to national parks and sanctuaries
- To highlight the scope of various branches of zoology to hone the vocational skills of the learner
- To develop soft-skills of the learner by conducting class room assignments and lab projects
- To make the learner aware of need for conservation of the environment, thus making him a better earthling



Semester I

Course I 18US1Z01

Non Chordates and Ecology

Module No.	Title	No. of Lectures	Credits
1	Non Chordates - Levels of organization, Protozoa to Annelida	12	02
2	Non Chordates - Arthropoda to Echinodermata	12	
3	Ecology	12	

Course II 18US1Z02

Molecular basis of Life - Protein and Carbohydrates, Basic Biotechnology and Genetics

Module No.	Title	No. of Lectures	Credits
1	Molecular Basis of Life - Proteins and Carbohydrates	12	02
2	Biotechnology Scope and Instrumentation	12	
3	Genetics	12	

	Practical 18US1ZOP (based on 18US1Z01 & 18US1Z02)	02
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Semester II

Course I 18US2Z01

Chordates and Ethology

Module No.	Title	No. of Lectures	Credits
1	Chordates - Protochordates to Reptiles	12	02
2	Chordates - Aves and Mammals	12	
3	Ethology	12	

Course II 18US2Z02

Molecular Basis of Life - Lipids and Nucleic Acids, Applications of Biotechnology and Evolution and Biodiversity

Module No.	Title	No. of Lectures	Credits
1	Molecular Basis of Life - Lipids and Nucleic Acids	12	02
2	Applications of Biotechnology	12	
3	Evolution and Biodiversity	12	

	Practical 18US2ZOP (based on 18US2Z01 & 18US2Z02)	02
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Semester - I

Course 1 - 18US1Z01

Non Chordates and Ecology

Module -I Non-Chordates- Levels of organization, Protozoa to Annelida (12 Lectures)

1.1 Levels of organization: Unicellular and multicellular organization, Diploblastic and triploblastic condition, development of coelom, symmetry, segmentation and cephalization.

Salient features with examples of phyla, subphyla and classes

1.2 Unicellular organization: Phylum Protozoa

1.3 Multicellular organization

1.3.1 Colonization level- Phylum Porifera

1.3.2 Division of labour (Cell differentiation)- Phylum Coelenterata

1.4 Triploblastic acoelomate and pseudocoelomate organization

1.4.1 Acoelomate organization - Phylum Platyhelminthes

1.4.2 Pseudocoelomate organization – Phylum Nemathelminthes

1.5 Triploblastic coelomate organization

1.5.1 Animals with metameric segmentation- Phylum Annelida

1.6 Recent advancement in phylogeny

Module -II Non-Chordates – Arthropoda to Echinodermata and Minor Phyla (12 Lectures)

2.1 Animals with jointed appendages- Phylum Arthropoda

2.2 Animals with mantle: Phylum Mollusca

2.3 Animals with enterocoel: Phylum Echinodermata

2.4 Minor Phyla

2.4.1 Ctenophora

2.4.2 Bryozoa

2.4.3 Nemertinea

2.4.4 Onychophora

Module III: Ecology (12 Lectures)

- 3.1 Scope and relevance of environmental science, Concept of Ecosystem
- 3.2 Energy flow, food chain and food web
- 3.3 Biogeochemical cycles (Carbon, Oxygen, Nitrogen, Phosphorus and Water cycles)
- 3.4 Human activities affecting biogeochemical cycles
- 3.5 Concepts of animal interactions: Symbiosis, Mutualism, Commensalism, Parasitism, Predation and Antibiosis

Course 2 - 18US1Z02

Molecular basis of Life - Protein and Carbohydrates, Basic Biotechnology and Genetics

Module I: Molecular basis of life – Protein and Carbohydrates (12 Lectures)

- 1.1 Biological micro- and macro-molecules
Monomeric constituents, polymers and significance of carbon.
- 1.2 Proteins
 - 1.2.1 Amino acids: Types based on carboxylic, amino and aromatic group.
Commercially important amino acids
 - 1.2.2 Peptide bond
 - 1.2.3 Structure of proteins: Primary, secondary, tertiary, and quaternary structure.
 - 1.2.4 Biological role of proteins.
- 1.3 Carbohydrates
 - 1.3.1 Nomenclature, classification, Glycosidic bond.



1.3.2 Types of carbohydrates with commercial importance: Monosaccharides: Glucose, fructose, galactose; Disaccharides: Maltose, sucrose, lactose; Polysaccharides: Starch, glycogen, cellulose, chitin, heparin

1.3.3 Biological role of carbohydrates

Module II: Basic Biotechnology (12 Lectures)

2.1 Concept of Biotechnology and an overview of achievements and scope.

2.2 Fundamentals of laboratory techniques in biotechnology

2.2.1 Introduction to basic instruments

Centrifuge, Incubator, BOD Incubator, Autoclave, Water Bath, Oven, Homogenizer, Colorimeter, Microscope and Laminar Air Flow

2.2.2 Aseptic techniques.

2.2.3 Principle and applications of Chromatography: Paper, adsorption and TLC, Electrophoresis – Agarose and PAGE

2.3 Food Biotechnology - Applications of biotechnology in making bread and cheese.

2.4 Enzyme technology – concept of enzyme immobilization, Applications in meat tenderization, fermentation

Module III: Genetics (12 Lectures)

3.1 Gene and gene concepts, definition of gene and gene expression

3.2 Recapitulation of Mendelian Genetics: Mendel's Laws of inheritance of characters, Monohybrid and dihybrid cross, Test Cross

3.3 Deviation from Mendel's laws of inheritance

3.3.1 Incomplete dominance, co- dominance

3.3.2 Gene interaction

i) Concept of gene interaction,

ii) Epistasis: recessive, dominant, double recessive and double dominant epistasis

3.3 Lethal genes

3.4 Extranuclear inheritance i) Cytoplasmic inheritance: Kappa particles in Paramecium.

ii) Maternal inheritance- shell coiling in Limnaea

3.5 Introduction to Human genetics:

i) Human traits that follow Mendelian patterns of inheritance

ii) Pedigree analysis: Autosomal dominant, recessive and X-linked traits

3.6 Applications of Genetics

i) Gene Therapy

ii) Eugenics

iii) Genetic counselling

iv) Fingerprinting – Crime case study

Practical 18US1ZOP (based on 18US1ZO1 & 18US1ZO2)

Practical 1

1. Levels of organization in Animals

A) Symmetry:

i) Asymmetric organization: Amoeba

ii) Radial symmetry: Sea anemone, Aurelia

iii) Bilateral symmetry: Planaria / liver fluke

B) Acoelomate: T.S. of Planaria / liver fluke

C) Pseudocoelomate: T.S. of Ascaris

D) Coelomate: T.S. of Earthworm

E) Segmentation

i) Pseudo segmentation: Tapeworm

ii) Metamerism: Earthworm

iii) Specialization of body parts for division of labour: Head, thorax and abdomen - Insect

F) Cephalization

i) Cockroach – Head

ii) Prawn/ crab – Cephalothorax

2. Canal system in sponges



3. Ciliary movement in paramecium

4. Section of cilium

5. Types of ingestion in amoeba

6. Study of nutritional apparatus: Amoeba, L.S. of Hydra, Planaria, digestive system of cockroach and earthworm, Amphioxus, Scroll valve of Shark, Bird digestive system and Ruminant stomach

7. Study of Cyclosis and chemotaxis in Paramoecium

8. Detection of gut enzymes in Cockroach

9. Detection of gut enzymes of vertebrate

10. Study of effect of pH on amylase activity.

11. Study of trachea and spiracles from cockroach, study of gills of fish, lung of frog and mammal, rate of oxygen consumption by cockroach (demonstration only)

12. Study of heart of cockroach, study of whole mount and L.S. of following hearts: Fish (2-chambered), Frog (3-chambered), Mammal (4-Chambered). Study of the rate of heart beat in Daphnia. Study of permanent slides of blood smear of frog and mammal.

13. Study of animal interaction: Commensalism: Echinus and Shark Mutualism: Hermit crab and Sea anemone, Termite and Trichonympha Antibiosis: Effect of antibiotic on bacterial growth on a petri plate Parasitism: Ectoparasite – Head louse and Bed bug Endoparasite: Trichinella spiralis Predation: Praying mantis and Spider

14. Study of population density by sub-sampling method.

15. Observation of representative specimens for each phylum



Paper II Practical

1. Introduction to basic laboratory safety practices, precautions and safety rules. Handling of common laboratory equipment (instrument and glassware): Burner, autoclave, centrifuge, colorimeter, balance, homogenizer, electrophoresis apparatus. Study of Microscope: Use, care and functions of its components.
2. Aseptic techniques: Autoclaving and Packaging of test tubes, pipettes, Petri plates, conical flask; Aseptic transfer of liquids between burners.
3. Paper chromatography for separation of amino acids.
4. Adsorption chromatography using chalk to separate plant pigments or other pigments.
5. Qualitative tests for proteins and carbohydrates.
6. Preparation of beads of calcium alginate for immobilization using yeast cells.
7. Assay of immobilized invertase from immobilised yeast cells by DNSA method (visual observation for comparative colour intensity in test tube)
8. To demonstrate fermentation of grape juice/sugar cane juice or any fruit juice – (Detection of alcohol generated during fermentation by benzoic acid).
9. Effect of Papain (raw papaya extract) as a meat tenderizer.
10. Human pedigree analysis: Dominant, recessive and X-linked characters.
11. Demonstration of Agarose Gel Electrophoresis



Semester II

Course 1 - 18US2Z01

Chordates - Protochordates, Chordates and Ethology

Module I: Chordates - Protochordates to Reptiles (12 Lectures)

1. Protochordates
2. Characteristics of vertebrates
3. Agnatha
4. Pisces (up to order)
5. Amphibian (up to order)
6. Reptiles (up to order)

Module II: Chordates - Aves and Mammals (12 Lectures)

1. Aves (up to order)
2. Mammals (up to order)
3. Beak and feet adaptation in birds
4. Mammalian order with adaptation

Module III: Ethology (12 Lectures)

3.1: Approaches to the study of behaviour.

3.2: Development of behaviour: Ontogeny of behaviour, Environmental influence on behaviour, sensitive periods during development, juvenile and innate behaviour

3.3: Animal learning: habituation, acquisition, extinction, classical conditioning, instrument learning and operant behaviour

3.3.1: Biological aspects of learning: Learning to avoid enemies, sickness and mimicry.

3.3.2: Cognitive aspects of learning: Hidden aspects of conditioning, nature of cognitive process, insight learning, associative learning and representation.



Course 2 - 18US2Z02

**Molecular basis of life – Lipids and Nucleic Acids Applications of Biotechnology,
Evolution and Biodiversity**

Module I: Molecular basis of life – Lipids and Nucleic Acids (12 Lectures)

1.1 Lipids

1.1.1 Fatty acids: Structure, types and properties

1.1.2 Mono-, di- and tri-glycerides

1.1.3 Phospholipids and sphingolipids

1.1.4 Sterols and waxes

1.1.5 Biological role of lipids

1.2 Nucleic acids

1.2.1 Origin, Chemical structure of nitrogenous bases, pentoses.

1.2.2 Nucleosides and nucleotides

1.2.3 Polynucleotides: 3' 5' phosphodiester linkage

1.2.4 Watson - Crick Model of DNA

1.2.5 Types of RNA: mRNA, t-RNA and r-RNA

1.2.6 Cloverleaf model of t-RNA

1.2.7 Differences between DNA and RNA

Module II: Applications of Biotechnology (12 Lectures)

2.1 Transgenic animals and animal cloning

2.1.1 Transgenic animals for production of pharmaceuticals: α -1-antitrypsin, tissue plasminogen activator (tPA)

2.1.2 Animal cloning experiments for "Dolly"

2.2 Medical Biotechnology

2.2.1 Biotechnology in production of insulin and hGH

2.2.2 Gene therapy: Ex vivo and In vitro approach, Gene therapy for SCID (severe combined immune deficiency) and cystic fibrosis

2.2.3 Ethical issues with reference to gene therapy

2.3 Environmental biotechnology

2.3.1 Bioremediation: Concepts and applications

2.4 Open educational resources – NCBI, PubMed, Various Multimedia platforms, Learn Biology etc.

Module III: Evolution and Biodiversity (12 Lectures)

3.1 Evolution

3.1.1 Origin of life: Emergence of life on primitive earth: Miller Urey Experiment, Oparin-Haldane concept.

3.1.2 Protobionts, Formation of Primitive Life

3.1.3 Evidences of Organic Evolution:

- i) Morphological, and Anatomical Evidences -Homologous and Analogous organs
- ii) Connecting Links- any 2 examples
- iii) Vestigial Organs
- iv) Palaeontological Evidences: Fossils, Fossilization, Dating of Fossils, Geological Time Scale

3.2 Biodiversity

3.2.1 Definition, Biodiversity hotspots, Benefits of Biodiversity, Biodiversity conservation, Bio - wealth of India.

3.2.2 Human activities affecting Biodiversity



Practical based on Theory Course I and II

18US2ZOP

Practical1

1. Types of tail fin in fish
2. Types of scales in fish
3. Comparison of cartilaginous and bony fish
4. Comparative of different morphology of Amphibia
5. Neoteny in Salamander
6. Endangered fish, amphibian, reptiles, birds and mammal
7. Comparative morphology of turtle and tortoise.
8. Component of snake venom and its effect
9. Types of feet in birds
10. Types of beaks in birds
11. Types of feathers in birds
12. Mounting of septal nephridium of earthworm, observation of sagittal section of mammalian kidney, Bowman's capsule (under high power).
13. Urine analysis for detection of normal and abnormal constituents.
14. Detection of uric acid from the excreta of bird or cockroach.
15. Detection of Ammonia as excretory product of fish from water.
16. Study of human eye and ear.
17. Observation of permanent slide of: Sponge gemmules, Hydra budding, Mammalian sperm, T.S. mammalian testis, T.S. mammalian ovary showing Graffian follicle, Observation of hen's egg with developing embryo at any stage of development.
18. Observation of representative specimens for each phylum and superclass of phylum Chordata

Practical 2

1. Qualitative tests for lipids.
2. Extraction and qualitative detection of nucleic acids:
 - a) DNA (SDS- NaCl Extraction)
 - b) RNA (Phenol extraction)
3. Identification with photographs: Methodology for transgenesis –
 - i) By microinjection into egg
 - ii) Transgenesis of embryonic stem cell
 - iii) Methodology for gene therapy for SCID or any human diseases
4. To evaluate the quality of milk by methylene blue reduction method.
5. Study of evidences of evolution:
6. A) Analogy – Leg of grasshopper and leg of mammal/ Wing of insect, wing of bird and wing of bat
B) Homology - Fore limb of an amphibian and a reptilian limb,/wing of bird and bat.
C) Study of fossils – Types and Examples
Trilobite, Ammonite, Hydrosaur head, Sivatherium- Indian Giraffe, Wooly mammoth skull

Scheme of examination –Theory

Internal Assessment: written test (30/25 marks) assignment (10/15 marks)

External Assessment: Semester end written test (60 marks) per course

Scheme of examination – Practical

Semester end examination – 100 Marks [50 marks per paper]



Semester End Theory Question Paper

(Paper I and II) Max. Marks: 60

Duration: 2 Hrs

1.	Describe any three (ON MODULE I) i. ii. iii. iv.	05 05 05 05 05
2.	Explain any three (ON MODULE II) i. ii. iii. iv.	05 05 05 05 05
3.	Write note on any three (ON MODULE III) i. ii. iii. iv.	05 05 05 05 05
4.	Enumerate on any three (MODULE I to MODULE III; MIX WEIGHTAGE) i. ii. iii. iv.	05 05 05 05 05



Practical Q.P. (I and II)

Max. Marks: 50; Duration: 3 Hrs

Q.No.		Max. Marks (50)
1.	Major Experiment	12 to 14
2.	Minor Experiment	08
3.	Identification	15 to 18
4.	Journal	03
5.	Viva voce	07