

AC/4.8.18/RS 1



College of Arts,
Science &
Commerce

RISE WITH EDUCATION
Sion (West), Mumbai – 400022
(Autonomous)

Faculty: Science

Program: F.Y.B.Sc.

Subject: ZOOLOGY

Academic Year: 2018 – 2019

**Credit Based Semester and Grading System approved
by Board of Studies in Zoology to be brought into effect
from June 2018**

F. Y. B. Sc. Zoology Syllabus (Autonomous)
Semester I and Semester II
(Credit Based Semester and Grading System, with effect from academic year 2018-19)

Preamble

“To educate means to draw out. Knowledge has to be drawn out of you, nobody can give it to you.”

Academic Autonomy brings forth the freedom of restructuring and refining the curriculum, which is pivotal in shaping the educational outcomes of an academic institution. Thus, a modest attempt has been made to design an effective syllabus for the subject of Zoology that will preserve the essence of the subject and also suit the contemporary education system, allowing critical thinking and developing attitudes necessary for scientific inquiry.

Some features of this syllabus are:

- ✓ *Taxonomical studies of animals, the core of Classical Zoology.*
- ✓ *Molecular basis of life, elaborating the relation between lifeless molecules and life.*
- ✓ *Animal behaviour study, signifying the importance of animals as part of the same world to which humans belong.*
- ✓ *Biodiversity, to sensitize about the biowealth nature has bestowed on humans, and to treat this natural resource with humane and responsible attitude in this era of global warming.*
- ✓ *Introduction to Biotechnology, an aspect inclined to benefit mankind through available biological resources with the aid of technology.*

This syllabus is a collective and constructive effort of the professors of Zoology at SIES College, Sion (West) and other board members from outside the institution whose suggestions and expertise were so valuable in conceptualizing this syllabus. It was approved by the Board of Studies (Ad hoc) in the meeting held on 16th June 2018 at the institution's department of Zoology.

As students have a boundless potential for searching, we hope this syllabus will allow them to reach out beyond the borders of the subject. This syllabus is an approach made to help sustain enthusiasm among students about the subject, that could be a stepping-stone in the career of some willing to explore the territories of Zoology.

*Dr. Satish Sarfare
Chairman,
Board of Studies in the subject of Zoology*

F. Y. B. Sc. Zoology Syllabus (Autonomous)
Credit Based Semester and Grading System
(With effect from academic year 2018-19)
Grid of Syllabus – Semester I

Theory				
Paper Code	Unit No.	Unit Name	Credits	Lectures/week
SIUSZO11	1	Diversity of Animal Kingdom - I	2	1
	2	Life Processes - I		1
	3	Ecology		1
Practical				
SIUSZO12	1	Molecular basis of life - I	2	1
	2	Biotechnology - I		1
	3	Genetics		1
SIUSZOP11	Based on SIUSZO11 (Practical I)		1	3
SIUSZOP12	Based on SIUSZO12 (Practical II)		1	3
Total			6	12

F. Y. B. Sc. Zoology Syllabus (Autonomous)
Credit Based Semester and Grading System
(With effect from academic year 2018-19)
Grid of Syllabus – Semester II

Theory				
Paper Code	Unit No.	Unit Name	Credits	Lectures/week
SIUSZO21	1	Diversity of Animal Kingdom - II	2	1
	2	Life Processes - II		1
	3	Ethology		1
SIUSZO22	1	Molecular basis of life - II	2	1
	2	Biotechnology - II		1
	3	Evolution and Biodiversity		1
Practical				
SIUSZOP21	Based on SIUSZO21 (Practical I)		1	3
SIUSZOP22	Based on SIUSZO22 (Practical II)		1	3
Total			6	12

Semester I – Theory

Paper Code: SIUSZO11

Diversity of Animal Kingdom - I, Life Processes - I and Ecology

Learning Objectives

- *To do an introductory survey of the diversity of animal life to understand that part of the world around us composed of animals. Also, to gain an insight on the evolutionary sequence of life from simpler to more complex ones, to which man himself belongs.*
- *To attempt an inquiry into the vital processes that make life possible through an understanding of the adaptations animals have evolved that best suit the milieu in which they thrive.*
- *To understand the relation between organisms and their environment through Ecology i.e., the study of “life at home”.*

Unit 1: Diversity of Animal Kingdom - I

Lectures 15

1.1: Levels of Organization

1.1.1: Unicellularity vs Multicellularity; formation of colonies

1.1.2: Organization of germ layers and fate of ectoderm, mesoderm and endoderm; Diploblastic and triploblastic condition; Division of labour and organization of tissues

1.1.3: Development of Coelom; Acoelomate, pseudocoelomate and coelomate organization

1.1.4: Radial and bilateral symmetry

1.1.5: Segmentation and cephalization

Salient features with examples of Phyla, Subphyla and Classes mentioned below:

1.2: Unicellular and Multicellular Organization

1.2.1: Unicellular organization: Phylum Protozoa

1.2.2: Multicellular organization: Colonization level – Phylum Porifera

1.2.3: Multicellular organization: Division of labour (Cell differentiation) – Phylum Cnidaria/Coelenterata

1.3: Triploblastic Acoelomate and Pseudocoelomate Organization

1.3.1: Acoelomate organization – Phylum Platyhelminthes

1.3.2: Pseudocoelomate organization – Phylum Nematelminthes

1.4: Triploblastic Coelomate Organization

1.4.1: Animals with metameric segmentation – Phylum Annelida

1.4.2: Animals with jointed appendages – Phylum Arthropoda

Unit 2: Life Processes - I

Lectures 15

2.1: Movement and Locomotion

2.1.1: Amoeboid movement

2.1.2: Ultrastructure of cilia and ciliary movements

2.1.3: Action of muscles (Role of muscles in movement)

2.2: Nutrition

2.2.1: Types of nutrition: Autotrophic and heterotrophic

2.2.2: Apparatus for nutrition:

a. Food vacuole: Animals without alimentary canal, ex. *Amoeba*

b. Animals with incomplete alimentary canal, ex. *Hydra*

c. Animals with complete alimentary canal, ex. bird

2.2.3: Physiology of digestion in vertebrates and symbiotic digestion in ruminants

2.3: Respiration

2.3.1: Types of respiratory surfaces:

a. General body surface: Cell membrane, ex. *Amoeba*; Skin, ex. earthworm and frog

b. Specialized respiratory structures: Trachea and spiracles, gills of fish, lungs of frog and human, air sacs of bird

2.3.2: External respiration and cellular respiration with reference to human

2.4: Circulation

2.4.1: Types of circulating fluids: Water, coelomic fluid, lymph and blood

2.4.2: Types of circulation: Protoplasmic streaming, open and closed circulation, single and double circulation

2.4.3: Hearts: Heart in *Daphnia*, cockroach and chordates (one, two, three and four-chambered hearts)

2.4.4: Structure of cardiac muscle

Unit 3: Ecology

Lectures 15

3.1:

Concept of Ecosystem

3.2:

Concepts of energy flow, food chain and food web

3.3: Biogeochemical cycles

3.3.1: Carbon cycle, oxygen cycle, nitrogen cycle, phosphorus cycle and water cycle

3.3.2: Human activities affecting biogeochemical cycles

3.4: Animal interactions

Symbiosis: Mutualism, commensalism, parasitism, predation and antibiosis

Semester I – Theory

Paper Code: SIUSZO12

Molecular basis of life - I, Biotechnology - I and Genetics

Learning Objectives

- *To develop an interest to learn the chemical language of life i.e., the molecular basis of life.*
- *To keep pace with technology that merges biological concepts, for its application for the betterment of human life through the study of Biotechnology.*
- *To improve our understanding of the genetic information – the molecular code of life, through Mendelism and to better understand the human race through a genetic perspective.*

Unit 1: Molecular basis of life - I

Lectures 15

1.1: Biological micromolecules and macromolecules

1.1.1: Monomeric constituents; Polymers

1.1.2: Significance of Carbon

1.2: Proteins

1.2.1: Amino acids: Types based on carboxylic, amino and aromatic groups

1.2.2: Peptide bond

1.2.3: Structure of proteins: Primary, secondary, tertiary and quaternary

1.2.4: Classification of proteins based on structure and function

1.2.5: Biological role of proteins

1.3: Carbohydrates

1.3.1: Nomenclature, isomerism and classification

1.3.2: Glycosidic bond

1.3.3: Types of carbohydrates:

a. Monosaccharides: Glucose, fructose, galactose

b. Disaccharides: Maltose, sucrose, lactose

c. Polysaccharides: Starch, glycogen, cellulose, chitin, heparin

1.3.4: Biological role of carbohydrates

Unit 2: Biotechnology - I

Lectures 15

2.1: Concept of Biotechnology

2.1.1: Definition

2.1.2: An overview of achievements and scope

2.2: Fundamentals of laboratory techniques in Biotechnology

2.2.1: Safe handling of equipments

2.2.2: Sterilization techniques

2.2.3: Molecular separation techniques

Principle and applications: Paper chromatography, Thin Layer Chromatography (TLC) and Electrophoresis – Agarose gel electrophoresis (AGE) and Polyacrylamide gel electrophoresis (PAGE)

2.3: Food Biotechnology

2.3.1: Applications of biotechnology in making bread, beer, wine, yogurt and cheese

2.4: Enzyme Technology

2.4.1: Enzymes as meat tenderizers

2.4.2: Biodetergents

2.4.3: Concept of enzyme immobilization

Unit 3: Genetics

Lectures 15

3.1:

Definition of gene; concept of genetics vs heritability; concept of mutation vs polymorphism

3.2: Mendelian Inheritance

3.2.1: Monohybrid and dihybrid cross

3.2.2: Concept of dominance

3.2.3: Exceptions to Mendelian Inheritance:

Incomplete dominance; Co-dominance; Interaction of genes – Epistasis: recessive, dominant, double recessive and double dominant epistasis; Lethal genes

3.3: Cytoplasmic Inheritance

3.3.1: Kappa particles in *Paramecium*; Sigma factor in *Drosophila* and shell coiling in *Limnaea*

3.4:

Effect of environment on heredity

3.5: Introduction to Human Genetics

3.5.1: Mendelian phenotypic traits in humans: Dominant, recessive and X-linked characters (two examples of each)

3.5.2: Pedigree analysis: Dominant, recessive and X-linked traits

3.5.3: Genetic counselling

- a. Risk of recurrence of hereditary diseases (thalassemia, haemophilia) in a family
- b. Risk of inheriting a disease from consanguineous marriage
- c. Risk of acquiring common hereditary diseases

Semester I – Practical (SIUSZOP11)

Practical I based on SIUSZO11

1. Levels of Organization in Animal Kingdom
 - a. Symmetry:
 1. Asymmetric organization: *Amoeba*
 2. Radial symmetry: Sea anemone, *Aurelia*
 3. Bilateral symmetry: *Planaria*/ liver fluke
 - b. Coelom condition:
 1. Acoelomate: T.S. of *Planaria*/ liver fluke
 2. Pseudocoelomate: T.S. of *Ascaris*
 3. Coelomate: T.S. of earthworm
 - c. Metamerism: Earthworm
 - d. Specialization of body parts for division of labour: Insect – Head, thorax and abdomen
 - e. Cephalization:
 1. Cockroach – Head
 2. Prawn/ crab – Cephalothorax
2. Animal Diversity
 - a. Phylum Protozoa: *Amoeba*, *Paramecium*, *Euglena*, *Plasmodium*
 - b. Phylum Porifera: *Leucosolenia*, Bath sponge
 - c. Phylum Cnidaria/ Coelenterata: *Hydra*, *Obelia colony*, *Aurelia*, Sea anemone and any one coral
 - d. Phylum Platyhelminthes: *Planaria*, liver fluke and tapeworm
 - e. Phylum Nematelminthes: *Ascaris* (male and female)
 - f. Phylum Annelida: *Nereis*, earthworm and leech
 - g. Phylum Arthropoda: Crab, lobster, *Lepisma*, beetle, dragonfly, butterfly, moth, spider, centipede, millipede
3. Study of *Paramecium* culture to observe food vacuole, contractile vacuole and ciliary movement.
4. Study of nutritional apparatus: *Amoeba*, L.S. of *Hydra* and *Planaria*, digestive system of cockroach and earthworm.
5. Study of activity of digestive enzymes from the gut of cockroach (from dead/ narcotized specimen).
6. Study of effect of pH and temperature on the activity of enzyme amylase/ trypsin.

7. Mounting of trachea and spiracles of cockroach (from dead/ narcotized specimen); study of gills of fish, lungs of frog and mammal; rate of oxygen consumption by cockroach (demonstration only).

8. Study of heart of cockroach; study of whole mount and L.S. of following hearts: fish (two-chambered), frog (three-chambered), mammal (four-chambered).

9. Determination of rate of heartbeat in *Daphnia*.

10. Study of permanent slides of blood smear of frog and mammal.

11. Study of Animal interactions:

a. Mutualism: Termite and *Trichonympha*

b. Antibiosis: Effect of antibiotics on bacterial growth in a petriplate

c. Parasitism: 1. Ectoparasite – Head louse and bed bug

2. Endoparasite – *Trichinella spiralis*

d. Predation: Praying mantis and spider

12. Determination of population density (*Daphnia* or any suitable organism) by subsampling method.

Semester I – Practical (SIUSZOP12)

Practical II based on SIUSZO12

1. Introduction to basic laboratory safety:

Safety rules and precautions; safety practices w.r.t. accidents which may occur while working in a laboratory (chemical spillage, burns, etc.); principle, working and use of fire extinguishers.

2. Handling of common laboratory equipments/ instruments: Burner, microscope, centrifuge, colorimeter, balance, homogenizer.

Handling of glassware

3. Aseptic techniques:

a. Autoclaving and packaging of test tubes, pipettes, petri plates and conical flasks.

b. Aseptic transfer of liquids between burners.

4. Separation of amino acids by ascending paper chromatography and thin layer chromatography (TLC).

5. Qualitative tests for proteins and carbohydrates.

6. Preparation of beads of calcium alginate for immobilization of enzyme amylase/ yeast cells.

7. Assay of immobilized amylase/ invertase from immobilised yeast cells by DNSA method (visual observation for comparing the colour intensity in test tubes).

8. Demonstrate agarose gel electrophoresis for the separation of egg white proteins and compare with a protein ladder or standard protein sample.

9. To demonstrate fermentation of grape juice/ sugar cane juice or any fruit juice (Detection of alcohol generated during fermentation by benzoic acid).

10. Effect of Papain (raw papaya extract) as a meat tenderizer.

11. Human Pedigree analysis: Dominant, recessive and X-linked characters.

Semester II – Theory

Paper Code: SIUSZO21

Diversity of Animal Kingdom - II, Life Processes - II and Ethology

Learning Objectives

- *To do an introductory survey of the diversity of animal life to understand that part of the world around us composed of animals. Also, to gain an insight on the evolutionary sequence of life from simpler to more complex ones, to which man himself belongs.*
- *To attempt an inquiry into the vital processes that make life possible through an understanding of the adaptations animals have evolved that best suit the milieu in which they thrive.*
- *To appreciate the significance of animals as part of the same world in which humans exist, through ethological study.*

Unit 1: Diversity of Animal Kingdom - II

Lectures 15

1.1: Triploblastic Coelomate Organization

1.1.1: Animals with mantle: Phylum Mollusca

1.1.2: Animals with enterocoel: Phylum Echinodermata

1.2: Phylum Hemichordata

1.3: Phylum Chordata

1.3.1: Subphylum Urochordata

1.3.2: Subphylum Cephalochordata

1.3.3: Subphylum Vertebrata

a. Division: Agnatha –

Class Cyclostomata

b. Division: Gnathostomata –

1. Class Pisces (Cartilaginous and bony fish)

2. Class Amphibia

3. Class Reptilia

4. Class Aves

5. Class Mammalia

Unit 2: Life Processes - II

Lectures 15

2.1: Excretion and Osmoregulation

2.1.1: Concepts of excretion and osmoregulation

2.1.2: Categorization of animals on the basis of principal nitrogenous excretory products

2.1.3: Ornithine cycle, formation of urea; deamination and detoxification

2.2: Control and Coordination

2.2.1: Irritability

2.2.2: Structure of neuron; sense organs – human eye and ear

2.2.3: Conduction of nerve impulse: Resting potential, action potential and refractory period

2.2.4: Synaptic transmission

2.2.5: Endocrine regulation: Hormones as chemical messengers; feedback mechanisms

2.3: Reproduction

2.3.1: Gametogenesis; structure of egg and sperm of mammal

2.3.2: Fertilization in animals; *In vitro* fertilization

2.3.3: Oviparity, viviparity and ovoviviparity

Unit 3: Ethology

Lectures 15

3.1: Development of Behaviour

3.1.1: Ontogeny of behaviour

3.1.2: Environmental influence on behaviour

3.1.3: Sensitive periods during development; Juvenile behaviour; Innate behaviour

3.2: Animal Learning

3.2.1: Conditioning and learning:

Classical conditioning; Acquisition; Extinction; Habituation and generalization

3.2.2: Instrument learning; Reinforcement; Operant behaviour

3.2.3: Biological aspects of learning:

Constraints of learning; learning to avoid enemies; mimicry; learning to avoid sickness; stimulus relevance

3.2.4: Cognitive aspects of learning:

Hidden aspects of conditioning; nature of cognitive process; insight learning; associative learning and representation

Semester II – Theory

Paper Code: SIUSZO22

Molecular basis of life - II, Biotechnology - II, and Evolution and Biodiversity

Learning Objectives

- *To develop an interest to learn the chemical language of life i.e., the molecular basis of life.*
- *To acknowledge the emerging field of Biotechnology that blends the technological advancements and the natural wealth – the living organisms, for improving human life.*
- *To acknowledge the importance of the natural treasure – the biodiversity around us, and to be judicious in the utilization of this natural economy.*

Unit 1: Molecular basis of life - II

Lectures 15

1.1: Lipids

- 1.1.1: Fatty acids: Structure, types and properties
- 1.1.2: Monoglycerides, diglycerides and triglycerides
- 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: Chemical structure of nitrogenous bases and 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, tRNA and rRNA
- 1.2.6: Cloverleaf model of tRNA
- 1.2.7: Differences between DNA and RNA

Unit 2: Biotechnology - II

Lectures 15

2.1: Transgenic Animals and Animal Cloning

- 2.1.1: Transgenic animals for production of pharmaceuticals: alpha-1-antitrypsin, tissue plasminogen activator (tPA)
- 2.1.2: Animal cloning experiments for “Dolly”

2.2: Biotechnology and Gene therapy

- 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 immunodeficiency) and Cystic fibrosis
- 2.2.3: Ethical issues with reference to gene therapy

2.3: Environmental Biotechnology

- 2.3.1: Bioremediation: Concepts and applications

2.3.2: Biodegradation of polycyclic aromatic hydrocarbons (PAHs) and petrochemicals

Unit 3: Evolution and Biodiversity

Lectures 15

3.1: Evolution

3.1.1: Origin of life: Emergence of life on primitive earth

3.1.2: Evolution and adaptations:

Microevolution, Role of Natural selection in microevolution, Co-evolution

3.2: Biodiversity

3.2.1: Definition; Biodiversity hotspots; Benefits of biodiversity; Biodiversity conservation; Biowealth of India

3.2.2: Human activities affecting biodiversity

3.2.3: Concept of ecological niche and adaptations

Semester II – Practical (SIUSZOP21)

Practical I based on SIUSZO21

1. Animal Diversity

- a. Phylum Mollusca: *Chiton*, *Dentalium*, *Pila*, bivalve, *Sepia* and *Nautilus*
- b. Phylum Echinodermata: Starfish, brittle star, sea urchin, sea cucumber, feather star
- c. Phylum Hemichordata: *Balanoglossus*
- d. Subphylum Urochordata: *Herdmania*
- e. Subphylum Cephalochordata: *Amphioxus*
- f. Division Agnatha: Class Cyclostomata: *Petromyzon*/ *Myxine*
- g. Class Pisces: Subclass Chondrichthyes: Shark, skates, sting ray/ electric ray
Subclass Osteichthyes: *Sciaena*, flying fish
- h. Class Amphibia: Frog, toad, caecilian, salamander
- i. Class Reptilia: Chameleon, *Calotes*, turtle/ tortoise, snake, alligator/ crocodile
- j. Class Aves: Kite, kingfisher, duck
- k. Class Mammalia: Shrew, hedgehog, guinea pig, bat

2. Study of wheel organ of *Amphioxus*, scroll valve of shark, digestive system of pigeon, ruminant stomach.

3. Mounting of septal nephridium of earthworm (from preserved specimen); Observation of sagittal section of mammalian kidney, Bowman's capsule (under high power).

4. Urine analysis for detection of normal and abnormal constituents; Detection of uric acid from excreta of bird or cockroach.

5. Study of irritability in *Paramecium* by demonstration of release of trichocysts.

6. Study of mammalian brain (entire and sagittal section with the help of specimen/ model); observation of T.S. of mammalian spinal cord.

7. Observation of permanent slides of:

Sponge gemmules, hydra budding, mammalian sperm, T.S. of mammalian testis, T.S. of mammalian ovary showing Graafian follicle; Observation of hen's egg with developing embryo at any stage of development.

8. Study of Mimicry:

Leaf insect, stick insect, stick worm (caterpillar), Kallima butterfly, Monarch butterfly and Common tiger butterfly.

Semester II – Practical (SIUSZOP22)

Practical II based on SIUSZO22

1. Thin layer chromatography of lipids using silica gel coated aluminium-backed TLC sheets and silica gel coated glass plates.
2. Adsorption chromatography using chalk to separate plant pigments or other pigments/ dyes (food colours).
3. Qualitative tests for lipids.
4. Extraction and qualitative detection of nucleic acids:
DNA (SDS-NaCl extraction); RNA (Phenol extraction)
5. Identification through photographs of methodology for transgenesis:
 - a. By microinjection into egg
 - b. Transgenesis of embryonic stem cell
 - c. Methodology for gene therapy for SCID (Severe combined immunodeficiency)
6. Study of bacteria using Gram stain (A mixture of bacteria and yeast cells to be given as sample).
7. To evaluate the quality of milk by Methylene blue reduction method.
8. Study of evidences of Evolution:
 - a. Analogy – Leg of grasshopper and leg of mammal; Wing of insect, wing of bird, wing of bat
 - b. Homology –Forelimb of amphibian/ reptilian and wing of bird/ bat
 - c. Any two fossils

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- Evolution: Strickberger, C.B.S. Publication
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- Biology; Seventh Edition; Neil A. Campbell & Jane B. Reece; Pearson Education, Inc.; 2005
- Biology; Student Edition; Kenneth R. Miller & Joseph S. Levine; Prentice Hall; 2007
- Biology: Eleventh Revised Edition; Sylvia S. Mader & Michael Windelspecht; McGraw-Hill Education; 2012
- Biology – Concepts & Applications; Sixth Edition; Cecie Starr; Brooks/ Cole; 2005

ADDITIONAL READING:

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**Practical Examination Question Paper Pattern
Semester I – Practical (SIUSZOP11)**

Practical I based on SIUSZO11

Time: 2 hours

Marks: 50

Q.1 Major Experiment

14

Effect of pH or temperature on amylase activity/ trypsin activity.

OR

Activity of digestive enzymes from the gut of cockroach (Invertase, amylase/ protease/ lipase).

OR

Determination of rate of heart beat of *Daphnia*.

Q.2 Minor Experiment

08

Temporary mounting of: Trachea/ mesothoracic or metathoracic or abdominal spiracle from cockroach/

Paramecium: food vacuole/ contractile vacuole/ ciliary movement

OR

Determination of population density of *Daphnia* or any suitable organism.

OR

Identification of parts of digestive system (any two) and explanation of their function from preserved (dead) dissected cockroach/ earthworm.

Q.3 Identification (3 marks each)

18

a. Levels of organization

b. Animal diversity (Protozoa to Platyhelminthes)

c. Animal diversity (Nemathelminthes to Arthropoda)

d. Animal interaction (commensalism/ mutualism/ antibiosis/ parasitism/ predation)

e. and f. Nutrition/ Respiration/ Circulation

Q.4 Viva

05

Q.5 Journal

05

Semester I – Practical (SIUSZOP12)

Practical II based on SIUSZO12

Time: 2 hours

Marks: 50

Q.1 Major Experiment

15

Demonstration of activity of immobilized enzyme: amylase or invertase.

OR

Qualitative tests for carbohydrates and proteins.

OR

Paper chromatography/ TLC for separation of amino acids.

Q.2 Minor Experiment

10

Fermentation of fruit juice or sugarcane juice and detection of alcohol by benzoic acid.

OR

Effect of papain as meat tenderizer.

OR

Preparation of beads of calcium alginate for immobilization of enzyme amylase or invertase.

OR

Pedigree analysis

OR

Packaging of glassware (any one) and aseptic transfer of liquid.

Q.3 Identification (3 marks each)

15

a., b. and c.: Laboratory instruments any three (burner/ centrifuge/ homogenizer/ balance/ colorimeter/ microscope/ any part of microscope)

d. and e. Laboratory Safety (lab coat/ goggles/ gloves/ rubber bulbs/ hazard symbols/ fire extinguishers)

Q.4 Viva

05

Q.5 Journal

05

Semester II – Practical (SIUSZOP21)

Practical I based on SIUSZO21

Time: 2 hours

Marks: 50

Q.1 Major Experiment

14

Detection of one normal and one abnormal constituent of urine OR any two abnormal constituents of urine.

OR

Detection of uric acid from the excreta of bird or cockroach.

Q.2 Minor Experiment

08

Detection of ammonia excreted by fish.

OR

Mounting of septal nephridium of earthworm.

OR

Study of irritability in *Paramecium* by demonstration of release of trichocysts.

Q.3 Identification (3 marks each)

18

a. Animal diversity (Mollusca to Cyclostomata)

b. and c. Animal diversity (Pisces to Mammalia)

d. Excretion, control and coordination (Sagittal section of mammalian kidney/ Bowman's capsule/ mammalian brain/ T. S. of mammalian spinal cord)

e. Reproduction (Sponge gemmule/ Hydra budding/ mammalian sperm/ T. S. of mammalian testis/ T. S. of mammalian ovary/embryonic stage of development of hen's egg)

f. Mimicry (Leaf insect/ stick insect/ Kallima butterfly/ Monarch and common tiger butterfly)

Q.4 Viva

05

Q.5 Journal

05

Semester II – Practical (SIUSZOP22)

Practical II based on SIUSZO22

Time: 2 hours

Marks: 50

Q.1 Major Experiment

14

Extraction and qualitative detection of DNA.

OR

Extraction and qualitative detection of RNA.

OR

Demonstration of Thin layer chromatography (TLC) of lipids and calculation of R_f value.

Q.2 Minor Experiment

a. Separation of pigments by adsorption chromatography using chalk and calculation of R_f value.

10

OR

Gram staining of bacteria.

b. Evaluation of quality of milk by methylene blue reduction method.

07

OR

Qualitative tests for lipids (any 2 tests).

Q.3 Identification (3 marks each)

09

a. Transgenesis (microinjection/ embryonic stem cells/ SCID)

b. Evolution (Homology/Analogy)

c. Study of fossils (Ammonite/ Trilobite)

Q.4 Viva

05

Q.5 Journal

05

**F. Y. B. Sc. Zoology Syllabus (Autonomous)
Credit Based Semester and Grading System
(With effect from academic year 2018-19)**

Scheme of Examination

The performance of learners will be evaluated in two parts for the Theory component of the Course:

1. Internal Assessment with 40% marks
2. Semester End Examination (written) with 60% marks

The Practical component of the Course will be evaluated by conducting Semester End Practical Examination of 50 marks.

Internal Assessment Theory (40%)

It is the assessment of learners on the basis of continuous evaluation as envisaged in the Credit Based System by way of participation of learners in various academic and correlated activities in the given semester of the program.

Marks: 40

1. Class test (Centralized Examination): **20 Marks**
2. At the departmental level evaluation will be conducted on the basis of Report submitted by the student on field visit to Zoo/ National Park/ Sanctuary/ Aquarium/ Fish Market/ Nature Conservation Centre/ any Educational institute in the vicinity: **20 Marks**

Semester End Assessment Theory (60%)

Marks: 60

Duration: 2 hours

Theory question paper pattern:

- There shall be four questions of 15 marks each. On each unit there will be one question and the 4th question will be based on the entire syllabus.

OR

There shall be three questions of 20 marks each, each question based on one unit.

- All questions are compulsory with internal choice within the questions.
- Questions may be subdivided and the allocation of marks depends on the weightage of the topic.

Semester End Assessment Practical

Marks: 50

Duration: 2 hours
