I Semester

THEORY PAPER: SYSTEMATICS AND ANIMAL DIVERSITY - I
(Protozoa to Hemichordata)

Course Description

Program Name	**B.Sc.**	**I Semester**	
Course Title	**Systematics and Animal Diversity - I** (Protozoa to Hemichordata)		
Course Code:	**DSCZOO-T1**	No. of Credits	**3**
Contact hours	**60 Hours**	Duration of SEA/Exam	**3 hrs.**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Out comes (COs): After the successful completion of the course, the student will be able to:

CO1. Group animals on the basis of their morphological characteristics/structures.
CO2. Demonstrate comprehensive identification abilities of Non-Chordate diversity.

CO3. Explain structural and functional diversity of Non-Chordates.

CO4. Develop understanding on the diversity of life with regard to Protists, non-chordates and chordates.

CO5. Examine the diversity and evolutionary history of a taxon through the construction of a basic phylogenetic/cladistics tree.

Course Pre-requisite(s): outcome.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Out comes(COs)/(POs)	DSCZOOT1	DSCZOOT2	
I Core competency	X		
II Critical thinking	X		
III Analytical reasoning	X		
IV Research skills	X		
V Team work	X		

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

Contents	60 Hrs.
Unit - I	**15 hrs.**
Chapter 1: Systematics. • Concept and significance of taxonomy. • Zoological classification- Uses, kinds of classification and Linnean hierarchy. • Rules and Codes of binomial nomenclature. • ICZN – features, code, ICZN rules, electronic publication. • Phylogenic tree- Features and types- Dendrogram, phenogram, cladogram, curvogram and phylogram. Significance of phylogram. • Recent trends in taxonomy- bar coding life. • Collection and preservation of natural history specimens.	**08**
Chapter 2: Introduction to Animal Architecture. • Outline classification of Kingdom Animalia up to the level of phyla. • Body organization: Levels of organization- Protoplasmic, cellular, tissue, and organ. • Body Symmetry - Definition and its types-asymmetry, spherical, radial, biradial and bi-lateral. • Germ layers – Definition and its types- Diploblastic (Apparent and absolute) and Triploblastic • Body Coelom – Definition, origin and its types- a coelom, pseudo coelom, eucoelom (Enterocoelome and schizocoelom. • Metamerism - Definition and its types with suitable examples- pseudometamerism, true metamerism- homonomous and heteronomous.	**07**
Unit II	**15**
Chapter 3: Protozoans, Poriferans and Coelenterates • **Phylum Protozoa:** General characteristics of the phylum; classification up to classes (At least two unique characters for each class) with suitable examples. • Types of nutrition: Autotrophic, holozoic, saprozoic, holophytic and parasitic with an example for each. • Locomotion: Amoeboid (Walking movement and Sol-Gel theory) - *Amoeba*, *Euglena* – Flagellar and euglenoid, ciliary movement – *Paramecium.* • Reproduction: Binary fission and conjugation in *Paramecium caudatum*; significance of conjugation. • **Phylum Porifera:** General characteristics of the phylum; classification up to classes (At least two unique characters for each class) with suitable examples. • *Sycon* - Morphology, T.S of body wall. • Canal system and its evolution: Asconoid, Syconoid, Leuconoid and Rhagonoid types. • **Phylum Coelenterata:** General characteristics of the phylum; classification up to classes (At least two unique characters for each class) with suitable examples. • Polymorphism with reference to *Halistemma* . • Coral reefs: Definition and its types. • Ctenophora – Salient features and its affinities.	**07** **03** **05**

UNIT III	15 hours
Chapter 4: Helminthes • **Phylum Platyhelminthes:** General characteristics of the phylum; classification up to classes (At least two unique characters for each class) with suitable examples. • **Phylum Nematoda:** General characteristics of the phylum; classification up to classes (At least two unique characters for each class) with suitable examples. **Chapter 5: Annelids** • **Phylum Annelida:** General characteristics of the phylum; classification up to classes (At least two unique characters for each class) with suitable examples. • Type study of Earthworm *(Pheretima posthuma)*- Morphology, digestive system, and excretory system. • Trochophore larva and its significance. **Chapter 6: Arthropods** • **Phylum Arthropoda:** General characteristics of the phylum; classification up to classes (At least two unique characters for each class) with suitable examples. • Peripatus: Affinities with Annelida and Arthropoda; systematic position. • Respiratory organs: Gills, book gills, trachea and book lungs. • Sense organs: Simple eye and compound eye. • Metamorphosis in insects and its types. • Neuro-endocrine regulation of metamorphosis in *Bombyx mori*.	**08** **07**
UNIT - IV	**15 hours**
Chapter 7: Molluscs **Phylum Mollusca:** General characteristics of the phylum; classification up to classes (At least two unique characters for each class) with suitable examples. • *Unio* - morphology, respiratory system and life cycle. • *Unio* shell - sectional view. • Modification of the foot: *Chiton, Dentalium, Pila, Aplysia, Mytilus, Sepia* and Octopus. **Chapter 8: Echinoderms and Hemichordates** **Phylum Echinodermata:** General characteristics of the phylum; classification up to classes (At least two unique characters for each class) with suitable examples. • *Asterias* – morphology and Water vascular system. • Structure and significance of Echinoderm larvae: Bipinnaria, Echinopluteus, Auricularia. **Phylum Hemichordata**: General characteristics. • Balanoglossus: morphology Modification of the coelom. • Tornaria larva and its significance.	**08** **07**

Pedagogy: ……

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	05
Classroom Performance/Participation	05
Total	**20 Marks**

PRACTICAL PAPER: Systematics and Animal Diversity - I
(Protozoa to Hemichordata)

Course Title	**Systematics and Animal Diversity - I** **(Practical)**	Practical Credits	**2**
Course Code	**DSCZOO-P1**	Contact Hours	**45 hrs.**
Formative Assessment	**10 Marks**	Summative Assessment	**40 Marks**

Course Pre-requisite(s):

Course Outcomes(COs):

At the end of the course the student should be able to:

1. Understand basics of classification of non-chordates.
2. Learn the diversity of habit and habitat of these species.
3. Develop the skills to identify different classes and species of animals.
4. Know uniqueness of a particular animal and its importance.
5. Enhancement of basic laboratory skill like keen observation and drawing.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Out comes(COs)/(POs)	DSCZOOP1	DSCZOOP2
I Core competency	X	
II Critical thinking	X	
III Analytical reasoning	X	
IV Research skills	X	
V Team work	X	

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

Practical Content

1. Scientific drawing using camera lucida.
2. **Protozoa**: Systematics of *Amoeba, Euglena, Noctiluca, Paramecium* and *Vorticella* (Permanent slides).
3. **Porifera:** Systematics of *Sycon, Euplectella, Hyalonema, Spongilla* and *Euspongia* (Specimens). Study of permanent slides of T.S of *Sycon*, spicules and gemmules.
4. **Cnidaria:** Systematics of *Aurelia* and *Metridium* (Specimens). Slides of *Hydra, Obelia*-polyp and medusa, and *Ephyra* larva, T.S. of *Metridium* passing through mesenteries.
5. **Stud y of Corals** - *Astraea, Fungia, Meandrina, Corallium, Gorgonia, Millepora* and *Pennatula.*
6. **Helminthes:** Systematics of *Planaria, Fasciola hepatica* and *Taenia solium,* Ascaris-Male and female (Specimens). Slides of T.S. of *Planaria,* T.S of male and female Ascaris.

7. **Annelida:** Systematics of *Nereis, Sabella, Aphrodite* and Leech (Specimens) Slide of T.S. of Earthworm through typhlosole. 8. **Arthropoda**: Systematics of *Panaeus, Palaemon, Astracus,* Scorpion, Spider, *Limulus, Peripatus, Millipede, Centipede,* Prayingmantis, Termite Queen, Moth, Butterfly, Dung beetle / Rhinocerous beetle (Any six specimens). Slide of Larvae-Nauplius, Zoea and Mysis. 9. **Mollusca:** Systematics of *Chiton, Mytilus, Aplysia, Pila, Octopus, Sepia* (Specimens) and Glochidium larva (Slide). 10. **Shell Pattern**-*Unio, Ostrea, Cypria, Murex, Nautilus, Patella, Dentalium,* Cuttlebone. (Any four). 11. **Echinodermata**: Systematics of Seastar, Brittlestar, Sea Urchin, Sea cucumber, Sealilly (Specimens). Slides of Bipinnaria larva, Echinopluteus larva and Pedicellaria. 12. **Harmful Non chordates:** Soil Nematodes. Agricultural, veterinary and human pests of Arachnida and Arthropoda. 13. **Beneficial Non-chordates:** • **Sericulture:** Lifecycle of *Bombyx mori*, Uzifly, Cocoon, Raw silk. • **Apiculture**: Any 2 Species of honeybee and bee wax. • **Pearl Culture**: Pearl Oyster and Natural Pearls. 14. **Virtual Dissection/Cultured specimens:** Earthworm –	

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

Note: Field visit to nearby National park/ Wildlife sanctuary/ any National laboratory at the end of semester is compulsory and the report of this is to be submitted along with practical record as a part of practical examination.

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**
House Examination/Test	05
Class room Performance/Participation	05
Total	**10 Marks**

References	
1	Barnes, R.S.K.; Calow,P.; Olive,P.J.W.; Golding,D.W.; Spicer, J.I.(2002) The Invertebrates: Synthesis, Blackwell Publishing.
2	Hickman,C.; Roberts,L.S.; Keen,S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.
3	Holland, P.(2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.
4	Kardong, K.V.(2006) Vertebrates: Comparative Anatomy, Function, Evolution (4thedition), McGraw-Hill.
5	Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.
6	Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.
7	Bushbaum, R. (1964) Animals without Back bones. University of Chicago Press.

BENGALURU CITY UNIVERSITY

Syllabus for

B.Sc. Zoology (UG)

CHOICE BASED CREDIT SYSTEM (CBCS)

Framed According to the State Educational Policy (SEP 2024)

I & II SEMESTERS

[To be implemented from the academic year 2024-25]

F O R E W O R D

As per the recommendations made by State Education Policy (SEP) led by Prof. Sukhdeo Thorat commission, the Government of Karnataka has reinforced the three-year degree programme from the academic year 2024-25. The new changes come close on the heels of students and colleges who have expressed concerns over the lack of clarity in pursuing a four year programme as per NEP. As per the recommendations, now colleges can offer degrees with three majors with a general degree in all six semesters; three majors up to fourth semester, and specialization in one subject in fifth and sixth semester or; a single subject specialization from first semester with minors. In addition to majors and specialization courses, the three subjects will be compulsory. First a course with practical (skill) orientation which is linked to the theoretical major course and is expected to improve employability. Students have to learn two languages: Kannada/ other Indian languages, and English. The third compulsory subject is value or moral education which will include teaching constitutional moral values/ principles of equality, liberty, fraternity, national unity, non-discrimination and similar values. Two electives that can be selected by the students based on the availability of courses may be discipline based or distinctly related to discipline based majors. It is recommended that a tutorial or assignment with a project component based on the survey which will give or involve practical experience may be included. It is also suggested that skill enhancement course with a tutorial based on the survey/laboratory be introduced for single subject specialization and deep specialization in 5th and 6th semesters. The examination pattern will be 80:20- 80 for the semester-end exam, and 20 for internal assessment. Likewise, for practical oriented science subjects, the examination pattern will be 40:10- 40 for the semester-end practical exam, and 10 for internal assessment.

The prominent features of the new scheme framework are:

1. Colleges can offer degrees with three majors -three majors up to fourth semester, and specialization in one subject in fifth and sixth semester or; a single subject specialization from first semester with minors. In addition to majors and specialization courses, the three subjects will be compulsory.
2. Students have to learn two languages: Kannada/ other Indian languages, and English.
3. The third compulsory subject is value or moral education which will include teaching constitutional moral values/ principles of equality, liberty, fraternity, national unity, non-discrimination and similar values.
4. Two electives that can be selected by the students based on the availability of courses may be discipline based or distinctly related to discipline based majors.

I am delighted to present curriculum structure pertaining to B. Sc Degree in subject Zoology. I hope that the curriculum structure and syllabus will pave the way for overall development of the student community. I ensure that, students community will procure the benefits at large in higher education.

Dr. P Mahaboob Basha
Chairman
BOS (UG) in Zoology
Bengaluru City University

Proceedings of the meeting of BOS in B. Sc Zoology of Bengaluru City University, Bengaluru.

Reference:

1. Constitution of BOS U.O dated 27.08. 2021.
2. G.O. ED: 166/UNE/2023, Bangalore dated 08.05.2024.
3. U.O. BCU/SYN/OPS/SEP/61/2024-25 dated 14.06.2024.

Adverting to above, the recommendations and drafted circulars made by SEP, Government of Karnataka pertaining to reinforcement of three-year degree courses with three majors was circulated by online mode to all the members of BOS along with proposed curriculum subjects for B. Sc Zoology, for scrutiny.

A workshop followed by Board of Studies meeting was held on **24th June, 2024** from 11.00am-5.00 pm, at central college Bengaluru City University, Bangalore to finalize the drafted syllabus pertaining to B.Sc. Zoology in accordance with SEP-2024.

AGENDA 1: Approval of syllabus for B. Sc in Zoology of 1st & 2nd semesters under SEP-2024.

Resolution: The proposed syllabi for BSc in Zoology, both theory and practical as well as the scheme of the examination for I and II semesters are scrutinized thoroughly, finalised with appropriate inclusion(s) and deletion(s) of content(s) and finally approved.

The meeting ended with a vote of thanks.
Following BOS members attended the meeting

Dr. P. MAHABOOB BASHA, Prof. of Zoology, Bangalore University, Bangalore-560056. **Chairman**

Mr. CHANDRAPPA, Associate Prof. of Zoology, GFGC, Yelahanka, Bangalore. **Member**

Dr. Hemalatha. A, Prof of Zoology, MCU Bangalore **Member**

Mrs. DHANALAKSHMI. N, Asst. Prof of Zoology, Vijaya College, RV Road, Bangalore. **Member**

Dr. TRIVENI C.E., Asst. Prof. V.V. Puram College of Science, K. R. Road, Bangalore. **Member**

Dr. SHUBHA M, Asst. Prof. in Zoology, BMS College for Women, Bengaluru. **Member**

Dr. ANNAPPA POOJARY, Professor of Zoology, Nrupatunga University, Bangalore. **Member Co-opted (E)**

Dr. ANIL GB, Asst. Prof. in Zoology, MES College, Bangalore- **Member Co-opted**

Dr. ASHALATHA, Assistant Professor in zoology Vijaya College, Bangalore. **Member Co-opted** 24/06/24

Dr. VINUTHA, Assistant Professor in zoology, Jyotinivas College, Bangalore. **Member Co-opted** 24/6/24

Dr. SRIKALA G, Professor of Zoology, GFGC, KR Puram. Bangalore. **Member Co-opted**

(P. MAHABOOB BASHA)
BOS Chairperson in Zoology & Genetics(UG)
Dr. P. MAHABOOB BASHA
Professor, Dept. of Zoology
Bangalore University,
Bangalore-560 056, INDIA.

BENGALURU CITY UNIVERSITY

DEPARTMENT OF ZOOLOGY

Credit framework for Science Stream (B. Sc) with 3-major subjects (3 + 2 C)

Semester	CORE-1 (T + P)	CORE-2 (T + P)	CORE-3 (T + P)	Elective (E)	Languages (1 & 2)	Compulsory Skill	Total credits
I semester	3 +2 = 5	3 +2 = 5	3 +2 = 5		L-1= 3 L-2= 3	C-1 (Constitution Values) = 2	23
II semester	3 +2 = 5	3 +2 = 5	3 +2 = 5		L-1= 3 L-2= 3	C-2 (Constitution Values) = 2	23
III semester	3 +2 = 5	3 +2 = 5	3 +2 = 5	E-1= 2	L-1= 3 L-2= 3		23
IV semester	3 +2 = 5	3 +2 = 5	3 +2 = 5	E-2= 2	L-1= 3 L-2= 3	Skill-1 = 2 (Pr.knowd.)	25
V semester (2 T^^ + 1 P)	3 +2 = 5 3 +0 = 3	3 +2 = 5 3 +0 = 3	3 +2 = 5 3 +0 = 3			Skill-2 = 2 (Pr.knowd.)	26
VI semester (2 T^^ + 1 P)	3 +2 = 5 3 +0 = 3	3 +2 = 5 3 +0 = 3	3 +2 = 5 3 +0 = 3			Skill-3 = 2 (Pr.knowd)	26
Total	36	36	36	4	24	10	146

All numerical may read as credits

Note- **(Two theory): 2** T ^^ with approval from Academic bodies.

BENGALURU CITY UNIVERSITY

DEPARTMENT OF ZOOLOGY

SCHEME OF EXAMINATION

Title of the Paper	Contact hrs./week	Exam hrs.	I. A	End Sem Ex. Marks	Total marks	Credits
FIRST SEMESTER						
Zoology-I: DSCZOO-T1 **Systematics and Animal Diversity - 1** (Protozoa To Hemichordata)	4	3	20	80	100	3
Zoology Practical- I: DSCZOO-P1 **Systematics and Animal Diversity- 1** (Protozoa To Hemichordata)	3	3	10	40	50	2
SECOND SEMESTER						
Zoology-II: DSCZOO-T2 **Animal Diversity -2** (Protochordata To-Mammalia)	4	3	20	80	100	3
Zoology Practical- II: DSCZOO-P2 **Animal Diversity -2** (Protochordata To-Mammalia)	3	3	10	40	50	2
THIRD SEMESTER						
Zoology-III: DSCZOO-T3 **Anatomy and Histology.**	4	3	20	80	100	3
Zoology Practical-III: DSCZOO-P3 **Anatomy and Histology**	3	3	10	40	50	2
*Zoology Elective-1: DSEZOO-1** **Biology of Parasites and Diseases**	3	2	10	40	50	2
FOURTH SEMESTER						
Zoology-IV: DSCZOO-T4 **Cell Biology and Genetics**	4	3	20	80	100	3
Zoology Practical-IV: DSCZOO-P4 **Cell Biology and Genetics**	3	3	10	40	50	2
*Zoology Elective-2: DSEZOO-2** **Biotechnology and Immunology**	3	2	10	40	50	2
SKILL-1: COMPULSORY **(Applied Zoology-I)** Title to be decided later	3	2	10	40	50	2
FIFTH SEMESTER						
Zoology-V: ZOO-T5 **Animal Physiology and Endocrinology**	4	3	20	80	100	3
Zoology Practical-V: DSCZOO-P5 **Animal Physiology and Endocrinology**	3	3	10	40	50	2
Zoology-VI: DSCZOO-T6 **Biostatistics and Techniques in Biology**	4	3	20	80	100	3
SKILL-2: COMPULSORY **(Applied Zoology-II)** Title to be decided later	3	2	10	40	50	2
SIXTH SEMESTER						
Zoology-VII: DSCZOO-T7 **Developmental Biology and Environmental Biology**	4	3	20	80	100	3
Zoology Practical-VI: DSCZOO-P6 **Developmental Biology and Environmental Biology**	3	3	10	40	50	2
Zoology-VIII: DSCZOO-T8 **Evolutionary Biology and Behavioural Biology**	4	3	20	80	100	3
SKILL-3/ Internship **(Applied Zoology-III)** Title to be decided later	3	2	10	40	50	2

Syllabus for B.Sc. in Zoology

Introduction

The curriculum framework takes into account the need to maintain globally competitive standards of achievement in terms of the knowledge and skills in Zoology and allied courses, as well develop scientific orientation, spirit of enquiry problem solving skills and human and professional values which foster rational and critical thinking in the students. This course serves as plethora of opportunities in different fields right from classical to applied Zoology.

PROGRAM OUTCOMES IN B. Sc Zoology (UG)

- **PO1** - Students gain knowledge and skill in the fundamentals of animal sciences, understands the complex interactions among various living organisms.
- **PO2** – Analyse complex interactions among the various animals of different phyla, their distribution and their relationship with the environment.
- **PO3** – Apply the knowledge of internal structure of cell, its functions in control of various metabolic functions of organisms.
- **PO4** – Understands the complex evolutionary processes and behaviour of animals.
- **PO5** – Correlating the physiological processes and relationship of organ systems.
- **PO6** – Understanding of environmental conservation processes and its importance, pollution control and biodiversity and protection of endangered species.
- **PO7** – Gain knowledge of Agro based Small Scale industries like sericulture, fish farming, butterfly farming and vermicomposting preparation.
- **PO8** – Understands about concepts of genetics and its importance in human health.
- **PO10** – Apply the knowledge and understanding of Zoology to one's own life and work
- **PO11** – Develops empathy and love towards the animals.
- **PO12**– To correlate the relationships among animals, plants and microbes.

Program Specific Outcomes:

- **PSO1**. Understand the nature and basic concepts of cell biology, genetics, taxonomy, physiology, ecology and applied Zoology.
- **PSO2**. Analyse the relationships among animals, plants and microbes.
- **PSO3**. Perform procedures as per laboratory standards in the areas of Taxonomy, Physiology, Ecology, Cell biology, Genetics, Applied Zoology, tools and techniques of Zoology, Toxicology, Entomology, Nematology, Sericulture, Biochemistry, Fish biology, Animal biotechnology, Immunology and research methodology.
- **PSO**4. Understand the applications of biological sciences in Apiculture, Aquaculture, Agriculture and Medicine.
- **PSO5**. Gains knowledge about research methodologies, effective communication and skills of problem solving methods.
- **PSO6**. Contributes the knowledge for Nation building.

GRADUATE ATTRIBUTES IN B.Sc. Zoology

Some of the characteristic attributes a graduate in Zoology should possess are:

- Develop the essential and fundamental skills required to enter the professional world of animal sciences. Tasks, including DNA analysis and trace evidence examination.
- Skilled communication and developing scientific knowledge.
- Critical thinking and problem solving capacity:
- Ethical awareness / reasoning.

Weightage for assessments

Type of Course	Formative Assessment / IA Marks	Summative Assessment Marks
Theory	**20**	**80**
Practical	**10**	**40**
Projects*		
Experiential Learning (Internships etc.)		

*In lieu of the research Project, two additional elective papers/ Internship may be offered.

Credit distribution for the course.

OUT line of the blue-print of Question papers to be prepared.
(% of share in each category)

THEORY

- Part – A: Short answer questions: (Answer any 5 out of 8) 5x 2 = 10
- Part – B: Medium size questions: (Answer any 6 out of 8)
  (to test overall understanding of subject): - 6x 5 = 30
- Part – C: Essay type questions: (Answer any 4 out of 5)
  (to test overall understanding of subject): - 4 X 10 = 40

Total Marks: 80

IA marks: 20

Total: 100

PRACTICALS

Total Practical exam Marks: 40

IA marks: 10

Total: 50

THEORY PAPER: Diversity of Life-II (PROTOCHORDATA TO MAMMALIA)

Program Name	**B.Sc.**	Semester	**II**
Course Title	**Animal Diversity - II (PROTOCHORDATA TO MAMMALIA)**		
Course Code:	**DSCZOO-T2**	No. of Credits	**3**
Contact hours	**60 Hours**	Duration of SEA/Exam	**3 hrs.**
Formative Assessment Marks	**20**	Summative Assessment Marks	**80**

Course Pre-requisite(s):

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1. To demonstrate comprehensive identification abilities of chordate diversity.
CO2. Able to explain structural and functional diversity of chordate diversity.
CO3. To understand evolutionary relationship amongst chordates.
CO4. To take up research in biological sciences.
CO5. To realize that very similar physiological mechanisms are used in very diverse organisms.
CO6. To Get a flavor of research by working on project besides improving their writing skills. It will further enable the students to think and interpret individually.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Out comes(COs)/(POs)	DSCZOOT1	DSCZOOT2	
I Core competency		X	
II Critical thinking		X	
III Analytical reasoning		X	
IV Research skills		X	
V Team work		X	

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

Contents	**60Hrs**
Unit -1	**15**
Chapter: 1 • General characters of chordates. Origin of chordates. • Basic Chordate characters and outline classification up to classes. **Protochordata**: **a. Cephalochordata**: • *Amphioxus* – Morphology, digestive system, feeding mechanism and circulatory system. **b. Urochordata**: • Type study of *Herdmania*- Morphology, tadpole of *Herdmania* and retrogressive metamorphosis.	**10**

Chapter 2: Agnatha • General characters and classification up to classes. • Salient features of Cyclostomata with examples. • Differences between lampreys and hag fishes. • Ammocoete larva and its significance.	**05**
Unit - II	**15 hrs**
Chapter 3: Super class: Pisces • Salient features and classification up to subclasses- • Differences between Chondrichthyes and Osteichthyes. • *Scoliodon*: Morphology, digestive system, circulatory system – afferent arterial system, neuromast organs (Lateral line sensory system and Ampullae of Lorenzini) and urinogenital system. • Parental care in fishes – (*Hippocampus, Tilapia*, Betta and *Arius jella*) • Salient features of Placodermi and Ostracodermi with examples. • *Dipnoi*: Interesting features and their evolutionary significance. **Chapter 4: Class Amphibia** • General characters and classification of class Amphibia up to living orders, with suitable examples. • Neoteny and Paedogenesis • Parental care in Amphibia – (*Pipa*, *Ichthyophis, Alytes, Gastrothecus*) • Origin of Amphibia.	**10** **05**
Unit - III	**15 hrs**
Chapter 5: Class Reptilia • General characters and outline classification of modern reptiles with suitable examples. • Adaptive radiation in extinct reptiles with suitable examples • Temporal fossae in reptiles. • Poisonous and non-poisonous snakes, Poison apparatus in snakes, venom and its types. Common poisonous snakes of India. Anti-venom. • Interesting features of *Sphenodon*. **Chapter 6: Class Aves** • General characters and classification up to orders with examples. • Differences between Ratitae and Carinatae. • Interesting features of *Archaeopteryx*. • Flight adaptations in birds (Morphological, anatomical and physiological) • Migration in Birds – Types, causes and theories.	**08** **07**
Unit: IV	**15 hrs**
Chapter 7: Class Mammalia • General characters and classification up to subclasses (Prototheria, Metatheria and Eutheria) with suitable examples. • Interesting features of mammalian orders- Insectivora, Carnivora (Pinnipedia and Fissipedia), Chiroptera (Mega and Micro), Cetacea (Mystoceti and Odontoceti), Proboscidia (Indian Elephant and African Elephant), Ungulata (Perissodactyla and Artiodactyla) and Primates (Platyrhini and Catarhini) with examples.	**10**

Chapter 8: Dentition in mammals • Definition, structure of molar tooth. • Types – Morphological, based on attachment, succession and kinds of teeth. Significance of teeth. • Dental formula (Horse, Dog, Man, Cat, Rabbit and Elephant) • Pattern of cheek teeth (Bunodont, Secodont, Selenodont and Lophodont). • Evolution of molar tooth.	**05**

Practical Paper: Animal Diversity - II (PROTOCHORDATA TO MAMMALIA)

Course Title	**Animal Diversity - II (PROTOCHORDATA TO MAMMALIA)**	Practical Credits	**2**
Course Code	**DSCZOO-P2**	Contact Hours	**45 hrs.**
Formative Assessment	**10 Marks**	Summative Assessment	**40 Marks**

Course Pre-requisite(s):

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Out comes(COs)/(POs)	DSCZOOP1	DSCZOOP2	
I Core competency		X	
II Critical thinking		X	
III Analytical reasoning		X	
IV Research skills		X	
V Team work		X	

Course Articulation Matrix relates course out comes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program outcome.

Practical Content
a. **Protochordata**: *Herdmania* and *Amphioxus*, T.S. of *Amphioxus* through pharynx and intestine. b. **Cyclostoma:** *Petromyzon, Ammocoete larva* and *Myxine.*
Pisces: a. Cartilaginous Fishes: *Narcine, Trygon, Pristis, Mylobatis.* b. Bony Fishes: Zebra fish, *Hippocampus, Muraena, Ostracion, Tetradon, Pleuronectus, Diodon and Echeneis* (Any four). c. Ornamental fishes: *Siamese*, *Koi*, *Oscar*, Betta Sp. *Neon tetra*, *Guppies*, Goldfish, Angel fish, Rainbow fish, *Molliesese*. d. Accessory respiratory organs: *Saccobranchus, Clarias and Anabas.*
Amphibia: a. *Rana, Bufo, Ambystoma, Axolotl larva, Necturus* and *Ichthyophis.*

Reptilia: a. *Turtle, Tortoise, Mabuya, Calotes, Chameleon, Varanus.* snakes – *Dryophis*, Rat snake, *Brahmini*, *Cobra, Krait, Russell's viper* and *Hydrophis* (Any four).
Aves: a. Beak and feet modification in Duck, Crow, Sparrow, Parrot, Kingfisher, Eagle or Hawk. (Any four).
Mammalia: a. *Mongoose, Squirrel, Pangolin, Hedge Hog, Rat, Loris* (Any four). **Mounting:** Preparation of whole mount of fish scale.
Virtual dissection/Cultured specimens: (Use of Dissected Animal or Photograph or Model) a. Shark/Bony fish: Afferent and Efferent branchial systems, glosso- pharyngeal and vagus nerves. b. Rat: Dissection (only demonstration)- Circulatory system (arterial and venous), Urinogenital system of both male and female rat.

Note: Field visit to nearby National park/ Wildlife sanctuary/ any National laboratory at the end of semester is compulsory and the report of this is to be submitted along with practical record as a part of practical examination.

Pedagogy:

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**
House Examination/Test	5
Written Assessment/Presentation/Project/Term Papers/Seminars	5
Total	**10 Marks**
Formative Assessment as per NEP guidelines are compulsory	

References	
1	Colbert *et al*: Colbert's Evolution of the Vertebrates: A history of the back boned animals through time. (5th ed. 2002, Wiley–Liss).
2	Hildebrand: Analysis of vertebrate Structure (4thed 1995, John Wiley)
3	Kenneth V. Kardong (20015) Vertebrates: Comparative Anatomy, Function, Evolution McGraw Hill
4	McFarland *et al.*- Vertebrate Life (1979, Macmillan publishing)
5	Parker and Haswell: Text Book of Zoology, Vol. II(1978,ELBS)
6	Romerand Parsons: The Vertebrate Body (6thed1986, CBS Publishing Japan)
7	Young: The Life of vertebrates (3rded 2006,ELBS/Oxford)
8	Weichert C. K. & William Presch (1970). Elements of Chordate Anatomy, Tata McGraw Hills

Scheme of Practical Examination

II Semester

PAPER II: [Code: DSCZOO-P2]

Animal Diversity - II

(PROTOCHORDATA TO MAMMALIA)

(Practical Based on code DSCZOO-T2)

Duration: 3 hrs. **Max Marks: 40**

Scheme of Examination

I. Identify the system and describe with a neat labelled diagram. **[07M]**
   a. [Shark – Afferent/Efferent/Cranial nerves;
   b. {Rat – Circulatory system / Urinogenital system}
      i. (Arterial/venous) (Male/Female)

II. Mounting of Scales **[04M]**
   (Placoid / Ctenoid /Cycloid)

III. Identification and comment on spotters - A to F **[6X4 = 24M]**

IV. Class Records. **[05 M]**

Scheme of Valuation

I. Identification of the system – **02M**; Flag labeling – **06M** (Minimum 06 labels)

II. Mounting – **3M**; Diagram & Comments – **02M**

III. Identification with classification – **01M**; Diagram & Comments – **02 M**

IV. Identification – **01 M**; comments – **02M**.

Scheme of Internal Assessment Marks:

Theory:

Sl. No.	Particulars	IA Marks
1	Attendance	05
2	Internal Tests (Minimum of Two)	10
3	Assignments /Seminar / Case Study / Project work / Reports on - Field visits made for observation and collection of data etc.,	05
	TOTAL Theory IA Marks	**20**

Practicals:

Sl. No.	Particulars	IA Marks
1	Practical Test	05
2	Active participation in practical classes (Attendance)	05
	TOTAL Theory IA Marks	**10**

III SEMESTER B.Sc., ZOOLOGY THEORY SYLLABUS

THEORY PAPER: ANATOMY AND HISTOLOGY

Program Name	**B.Sc.**	**Semester:**	**III**
Course Title	**Anatomy and Histology**		
Course Code:	**DSCZOO-T3**	No. of Credits:	**3**
Contact hours:	**56 Hours**	Duration of SEA/Exam:	**3 hrs.**
Formative Assessment Marks:	**20**	Summative Assessment Marks:	**80**

Course Out comes (COs): After the successful completion of the course, the student will be able to:

CO1: Demonstrate a thorough understanding of the human body's anatomical structures including bones, muscles, organs and systems.

CO2: Study the comparative account of organs of vertebrates and their functions.

CO3: Acquire the knowledge of structure of brain, sense organs and excretory organs to a complex, highly evolved form in mammal.

CO4: Understand the microscopic organization of tissues and organs through histological studies.

CO5: To comprehend the fundamental principles of micro technique, identifying the role of various reagents in the preparation of tissue samples.

Course Pre-requisite(s): outcome

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Outcomes (COs)/(POs)	DSCZOO-T3
I Core competency	X
II Critical thinking	X
III Analytical reasoning	X
IV Research skills	X
V Team work	X

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program.

Content	56 hrs
Unit I	**14 hrs**
Human Anatomy - 1 • Anatomy of Digestive system - Structure of alimentary canal and accessary glands (Liver and Pancreas). • Anatomy of Respiratory system – conducting part and respiratory zone. • Anatomy of Circulatory system - V.S of Heart, origin and conduction of heartbeat. • Anatomy of Excretory system and structure of nephron. • Anatomy of Nervous system – CNS, PNS and ANS, structure of multipolar neuron, anatomy of brain.	
Unit II	**14 hrs**
Human Anatomy – 2 and Osteology • Anatomy of Reproductive system – structure of male and female reproductive systems. • Sense organs - Eye and Ear. • Skeletal system - functions, Types of bones, Axial and appendicular skeletal system (except bones of hand and foot). • Joints and their types – Immovable joints, slightly movable joints and freely movable (synovial joints). • Synovial joint – L.S of synovial joint, types – Ball & socket joint, hinge joint, saddle joint, plane joint, condyloid joint and pivot joint.	
Unit III	**14 hrs**
Comparative Anatomy • Respiratory organs in Fishes (shark gills), respiratory organs in Amphibians (gills and lung), Reptiles, Birds and Mammals (rabbit lung). • Comparative anatomy of heart in vertebrates. • Evolution of kidney in vertebrates - Pronephros, Mesonephros and Metanephros of vertebrates. • Comparative anatomy of brain in vertebrates.	
Unit IV	**14 hrs**
Histology • Introduction, Tissues and its types - Epithelial tissues; connective tissue (loose and dense); skeletal tissue and muscular tissue. • Micro-technique - Steps in histological techniques (fixation, dehydration, embedding, sectioning, mounting and differential staining); Common fixatives and stains; Uses of alcohol, xylene and DPX. • Histological features of mammalian organs - Tongue, Stomach, Thyroid, Pancreas, Liver, Kidney, Adrenal, Testis and Ovary.	

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

Formative Assessment for Theory	
Assessment Occasion / type	**Marks**
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	05
Classroom Performance/Participation	05
Total	**20 Marks**

III SEMESTER B.Sc., ZOOLOGY PRACTICAL SYLLABUS

PRACTICAL PAPER: ANATOMY AND HISTOLOGY

Course Title:	**Anatomy and Histology**	Practical Credits:	**2**
Course Code:	**DSCZOO-P3**	Contact Hours:	**30 hrs**
		Hours / Week:	**03 hrs**
Formative Assessment:	**10 Marks**	Summative Assessment:	**40 Marks**

Course Outcomes (COs): After the completion of the course, the student will be able to:

CO1: To understand the anatomical structure of organs of human body.
CO2: To comprehend the intricate structure of human skeletal system.
CO3: To appreciate the comparative account of different organs of vertebrates.
CO4: Develop proficiency in staining different histological tissues for proper viewing and understanding.

Course Pre-requisite(s):

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Outcomes (COs)/(POs)	DSCZOO-P3
I Core competency	X
II Critical thinking	X
III Analytical reasoning	X
IV Research skills	X
V Team work	X

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

Sl. no	Practical Contents	10 Units
1	**Human Anatomy:** Virtual Display / Model / Photos: Structure of Lung, Heart and Brain	
2	**Human Osteology:** Skull, Lower jaw, vertebral column, sternum, ribs, pectoral and pelvic girdles, limb bones (except bones of hand and foot).	
3	Comparative anatomy of skin of Vertebrates – Fish, Frog and Rabbit.	
4	Comparative anatomy of heart of Vertebrates: Fish (Shark), Amphibian (Frog), Bird, (Pigeon) and Mammal (Rabbit).	

5	Comparative anatomy of brain of Vertebrates: Fish (Shark), Amphibian (Frog), Bird (Pigeon) and Mammal (Rabbit).	
6	**Histology:** Permanent slides of sections of mammalian organs - Tongue, Stomach, Pancreas, Liver, Thyroid, Kidney, Adrenal, Ovary and Testis.	
7	Micro-technique: Preparation and Staining.	

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**
House Examination/Test	05
Class room Performance/Participation	05
Total	**10 Marks**

References:

1. Gerard J Tortora and Nicholas P. Anagnostakos. 13th Ed. Principles of Anatomy and Physiology.
2. Clemente C D. 1981. Anatomy- A Regional Atlas of The Human Body, Urban and Schwarzenberg Publications 2nd Edition.
3. Chaurasia B D. 1986. Human Anatomy- Regional and Applied Upper Limb and Thorax, Cbs Publishers and Distributors.
4. Preves M, Lysenkov N, Bushkovich V. 1985.Human Anatomy, Mir Publications.
5. Vimala C.M, 2006. Introductory Zoology Vol. IV, Interline Publishing, Bangalore.
6. Grove & Newell, 1990. Animal Biology, Universal Book Stall, New Delhi, 9th Ed.
7. Hilderbrand. 1988 Analysis of Vertebrate Structure John Wiley and Sons, New York, 3rd Ed.
8. Kotpal R.L.1991.Vertebrates, Rastogi Publications, Meerut
9. Kotpal R.L.1993. Zoology Phylum Series, Rastogi Publications, Meerut
10. Kulshrestha S.K.1999.Comparative Anatomy of Vertebrates, Anmol Publications.
11. Vimala C.M, 2006. Introductory Zoology Vol. IV, Interline Publishing, Bangalore.
12. Frederick R. Bailey. Bailey's Textbook of Histology
13. Vimala C.M. 2006. Introductory Zoology Vol. V, Interline Publishing, Bangalore.
14. Brijesh kumar. 2013. Histology: Text & Atlas.

III SEMESTER B.SC., ZOOLOGY ELECTIVE - 1 SYLLABUS

THEORY PAPER: BIOLOGY OF PARASITES AND DISEASES

Program Name:	**B.Sc.**	**Semester**	**III**
Course Title:	**Biology of Parasites and Diseases**		
Course Code:	**DSEZOO-1**	No. of Credits	**2**
Contact hours:	**28 Hours**	Duration of SEA/Exam	**1.5 hrs**
		Hours / Week	**2**
Formative Assessment Marks:	**10**	Summative Assessment Marks	**40**

Course Out comes (COs): After the successful completion of the course, the student will be able to:

CO1: Describe the mechanisms for transmission, virulence and pathogenicity in pathogenic micro-organisms.

CO2: Know the stages of the life cycles of the parasites and infective stages.

CO3: Diagnose the causative agents, describe pathogenesis and treatment for important diseases like malaria, HPV, HIV, dengue, leishmaniasis, trypanosomiasis, schistosomiasis, cysticercosis, filariasis etc.

CO4: Carry out common procedures for culturing, purifying and diagnostics of micro-organisms Understand the disease-causing potential of bacteria and viruses, and the responses of the immune system.

CO5: Develop skills and realize significance of diagnosis of parasitic infection and treatment.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Outcomes (COs)/(POs)	DSEZOO-1
I Core competency	X
II Critical thinking	X
III Analytical reasoning	X
IV Research skills	X
V Team work	X

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program

Contents	28 hrs
Unit I	**14 hrs**
Parasites • Introduction to Parasites and its types, host and its types, parasitoids, zoonosis with examples. • Occurrence, disease caused, mode of transmission and control measures of the following parasites: *Mycobacterium tuberculosis, Salmonella typhi*, Human papilloma virus (HPV), SARS Covid-2**.** • Study of morphology, occurrence, disease caused, mode of transmission and control measures of *Leishmania donovani, Entamoeba histolytica and Plasmodium vivax.* • Study of morphology, occurrence, disease caused, mode of transmission and control measures of *Taenia solium and Schistosoma haematobium.*	
Unit - II	**14 hrs**
Parasitic Nematodes and Arthropods • Study of morphology, occurrence, disease caused, mode of transmission and control measures of *Ancylostoma duodenale*, *Ascaris lumbricoides* and *Wuchereria bancrofti.* • **Parasitic Arthropods:** Biology, Importance and Control measures of Ticks (Soft tick-*Ornithodoros*, Hard tick- *Ixodes*), Mites (*Sarcoptes*), Lice (*Pediculus*), Flea (*Xenopsylla*), Bug (*Cimex*), Parasitoid (Wasps). **Laboratory Diagnosis of Parasitic Diseases** • Diagnostic methods of parasitology: Introduction, Examination of the human samples for parasitic isolation and identification: Blood, Stool and Sputum. • Methods of Diagnosis: Immuno diagnosis, Skin Method, Culture methods of parasites. • Diagnostic techniques for HPV (Pap Smear and RT – PCR) and SARS Covid (viral nucleic acid detection by RT-PCR)	

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
House Examination/Test	05
Classroom Performance/Participation	05
Total	**10 Marks**

References:

1. Essentials of Medical Parasitology: Apurba Sankar Sastry and Sandhya Bhat K, Jaypee Brothers Medical Publishers, 2014.
2. Paniker's Textbook of Medical Parasitology: CK Jayaram Paniker and Sougata Ghosh, 8th Edition, Jaypee Brothers Medical Publishers, 2018
3. Introduction to Animal Parasitology (2nd Edition.): Smith D G. John Willey Sons, NY. 1997
4. Parasitology: Sood R. C.B.S. publishers, New Delhi, 1995.
5. Foundations of Parasitology (2nd Edition): Roberts L S and Janovy J (Jr) McGraw Hill Publ. 2000.

ಬೆಂಗಳೂರು ನಗರ ವಿಶ್ವವಿದ್ಯಾಲಯ
BENGALURU CITY UNIVERSITY
ಆಗು ಏ ಅಪಕೇತಾ
BE BOUNDLESS

BENGALURU CITY UNIVERSITY

Syllabus for

B.Sc. Zoology (UG)

CHOICE BASED CREDIT SYSTEM (CBCS)

Framed According to the State Educational Policy (SEP 2024)

I and IV SEMESTERS

[To be implemented from the academic year 2025-26]

BENGALURU CITY UNIVERSITY, BENGALURU
Proceedings of the meeting of BOS (UG) in Zoology and Genetics

Ref: 1) BCU/BOS/SEP/376/2024-25 Dated, 29-01-2025
2) BCU/Syn/BOS/Zoology & Genetics (UG)/404/2024-25 Dated 03-03-2025

The Chairperson – BOS in Zoology / Genetics, Bengaluru City University, Bengaluru greeted the BOS Members before the commencement of the meeting

A meeting of Board of Studies in Zoology and Genetics of BCU was held on 11th and 12th March 2025 (during 10.30am to 4.30pm) at Department of Zoology, Bengaluru City University, Bengaluru to scrutinize the drafted syllabus pertaining to B.Sc. Zoology and Genetics, Bengaluru City University in accordance with SEP-2024

Agenda 1: Approval of Syllabi for 3rd – 4th Semester B.Sc., Zoology and B.Sc., Genetics under SEP-2024
Resolution: The proposed syllabus for 3rd – 4th Semester B.Sc., Zoology and B.Sc., Genetics (both theory and practical) and as well as the scheme of examination were scrutinized thoroughly, finalized with appropriate inclusion(s) deletion(s) of the contents and finally approved on 12th March 2025.

Agenda 2: Approval of panel of examiners for B.Sc., Zoology and B.Sc., Genetics for the academic year 2025-2026
Resolution: The given panel of examiners for UG Zoology and Genetics for the year 2025-2026 were scrutinized thoroughly, finalized with appropriate inclusion(s) deletion(s) of the contents and finally approved.
The meeting was concluded with the chairperson thanking all the members for rendering cooperation for the smooth conduct of the meeting.

The following BOS members attended the meeting

Sl.No	Name of the Chairman / Member	Designation	Signature
1.	Dr.B P Harini, Professor & Chairperson, Dept. of Zoology, Bangalore University, Bengaluru-560056 (Ph.No:9448939066)	Chairperson	
2.	Dr. Ashalatha, Associate Professor, Vijaya College, R.V. Road, Bengaluru-560004 (Ph.No.9480019720)	Member	
3.	Dr. Rama Krishnaiah, Associate Professor, M.S Ramaiah College, Bengaluru (Ph.No.9611928200)	Member	
4.	Gopala Krishna, Associate Professor, Dept. Genetics & Biotechnology, Vijaya College, R.V. Road, Bengaluru-560004 (Ph.No.7019272375)	Member	ABSENT
5.	Dr. Salma Banu, Associate Professor, Seshadri Puram, First Grade College, Yelahanka (Ph.No. 9886703351)	Member	
6.	Dr. Shubha M, Assistant Professor, Department of Zoology, BMS College for Women, Basavanagudi, Bengaluru – 560 004 (Ph.No. 9900782822)	Member	
7.	Dr.C.E. Thriveni, Assistant Professor, V.V. Puram College of Science, Bengaluru-4. (Ph.No. 9902452934)	Member	
8.	Dr. Anil G.B. Assistant Professor, MES Degree College of Arts, Science & Commerce, Malleshwaram, Bengaluru (Ph.No.9611325048)	Member	
9.	Dr. Abhinandini I, David, Associate Professor, Maharanis College for Womens, Mysore, (Ph.No. 9964123301)	Member	
10.	Dr. J.S. Asha Devi, Professor, Dept. of Zoology, Yuvarajas College Mysore (Ph.No.9448258374	Member	ABSENT
11.	Dr. Rakesh H, Faculty, Dept. of Zoology, BUB	Co-opt Member	
12.	Dr. Shalini M, Faculty, Dept. of Genetics, BUB	Co-opt Member	

Yours Sincerely,

(B.P.HARINI)
BOS Chairperson- BCU

PROFESSOR AND CHAIRPERSON
Department of Zoology
Bangalore University, Jnanabharathi
Bengaluru - 560 056

F O R E W O R D

As per the recommendations made by State Education Policy (SEP) led by Prof. Sukhdeo Thorat commission, the Government of Karnataka has reinforced the three-year degree programme from the academic year 2024-25. The new changes come close on the heels of students and colleges who have expressed concerns over the lack of clarity in pursuing a four-year programme as per NEP. As per the recommendations, now colleges can offer degrees with three majors with a general degree in all six semesters; three majors up to fourth semester, and specialization in one subject in fifth and sixth semester or; a single subject specialization from first semester with minors. In addition to majors and specialization courses, the three subjects will be compulsory. First a course with practical (skill) orientation which is linked to the theoretical major course and is expected to improve employability. Students have to learn two languages: Kannada/ other Indian languages, and English. The third compulsory subject is value or moral education which will include teaching constitutional moral values/ principles of equality, liberty, fraternity, national unity, non-discrimination and similar values. Two electives that can be selected by the students based on the availability of courses may be discipline based or distinctly related to discipline-based majors. It is recommended that a tutorial or assignment with a project component based on the survey which will give or involve practical experience may be included. It is also suggested that skill enhancement course with a tutorial based on the survey/laboratory be introduced for single subject specialization and deep specialization in 5th and 6th semesters. The examination pattern will be 80:20-80 for the semester-end exam, and 20 for internal assessment. Likewise, for practical oriented science subjects, the examination pattern will be 40:10-40 for the semester-end practical exam, and 10 for internal assessment.

The prominent features of the new scheme framework are:

1. Colleges can offer degrees with three majors-three majors up to fourth semester, and specialization in one subject in fifth and sixth semester or; a single subject specialization from first semester with minors. In addition to majors and specialization courses, the three subjects will be compulsory.
2. Students have to learn two languages: Kannada/ other Indian languages, and English.
3. The third compulsory subject is value or moral education which will include teaching constitutional moral values/ principles of equality, liberty, fraternity, national unity, non- discrimination and similar values.
4. Two electives that can be selected by the students based on the availability of courses may be discipline based or distinctly related to discipline-based majors.

I am delighted to present curriculum structure pertaining to B.Sc., Degree in subject Zoology. I hope that the curriculum structure and syllabus will pave the way for overall development of the student community. I ensure that, student's community will procure the benefits at large in higher education.

Dr. B. P. HARINI
Chairperson - BOS (UG)
Zoology & Genetics
Bengaluru City
University

BENGALURU CITY UNIVERSITY

DEPARTMENT OF ZOOLOGY

Credit framework for Science Stream (B. Sc.,) with 3-major subjects (3 + 2 C)

Semester	CORE-1 (T + P)	CORE-2 (T + P)	CORE-3 (T + P)	Elective (E)	Languages (1 & 2)	Compulsory Skill	Total credits
I semester	3 +2 = 5	3 +2 = 5	3 +2 = 5		L-1= 3 L-2= 3	C-1 (Constitution Values) = 2	23
II semester	3 +2 = 5	3 +2 = 5	3 +2 = 5		L-1= 3 L-2= 3	C-2 (Constitution Values + EVS) = 4	25
III semester	3 +2 = 5	3 +2 = 5	3 +2 = 5	E-1= 2	L-1= 3 L-2= 3		23
IV semester	3 +2 = 5	3 +2 = 5	3 +2 = 5	E-2= 2	L-1= 3 L-2= 3	Skill-1 = 2 (Pr.knowd.)	25
V semester (2 T^^ + 1 P)	3 +2 = 5 3 +0 = 3	3 +2 = 5 3 +0 = 3	3 +2 = 5 3 +0 = 3			Skill-2 = 2 (Pr.knowd.)	26
VI semester (2 T^^ + 1 P)	3 +2 = 5 3 +0 = 3	3 +2 = 5 3 +0 = 3	3 +2 = 5 3 +0 = 3			Skill-3 = 2 (Pr.knowd)	26
Total	36	36	36	4	24	12	148

All numerical may read as credits

Note **- (Two theory): 2** T ^^ with approval from Academic bodies.

BENGALURU CITY UNIVERSITY
CREDIT DISTRIBUTION FOR THE COURSE
CURRICULUM FOR B. Sc., ZOOLOGY (UG) 2025-26

Title of the Paper	Total no. of hours	Contact hrs./week	Exam hrs.	I. A	End Sem Ex. Marks	Total marks	Credits
1st and 2nd Semester (Revised as per SEP 2025-2026)							
FIRST SEMESTER							
Zoology-I: DSCZOO-T1 **Systematics and Animal Diversity - 1** (Protozoa To Hemichordata)	56 hrs	4	3	20	80	100	3
Zoology Practical- I: DSCZOO-P1 **Systematics and Animal Diversity- 1** (Protozoa To Hemichordata)	30 hrs	3	3	10	40	50	2
SECOND SEMESTER							
Zoology-II: DSCZOO-T2 **Animal Diversity -2** (Protochordata To-Mammalia)	56 hrs	4	3	20	80	100	3
Zoology Practical- II: DSCZOO-P2 **Animal Diversity -2** (Protochordata To-Mammalia)	30 hrs	3	3	10	40	50	2
3rd and 4th (Framed as per SEP 2025-2026)							
THIRD SEMESTER							
Zoology-III: DSCZOO-T3 **Anatomy and Histology.**	56 hrs	4	3	20	80	100	3
Zoology Practical-III: DSCZOO-P3 **Anatomy and Histology**	30 hrs	3	3	10	40	50	2
*Zoology Elective-1: DSEZOO-1** **Biology of Parasites and Diseases**	28 hrs	2	1.5	10	40	50	2
FOURTH SEMESTER							
Zoology-IV: DSCZOO-T4 **Cell Biology, Immunology and Genetics**	56 hrs	4	3	20	80	100	3
Zoology Practical-IV: DSCZOO-P4 **Cell Biology, Immunology and Genetics**	30 hrs	3	3	10	40	50	2
*Zoology Elective-2: DSEZOO-2** **Food, Health and Nutrition**	28 hrs	2	1.5	10	40	50	2
SKILL-1: COMPULSORY **Applied Zoology-I (Economic Zoology)**	30 hrs	3	3	10	40	50	2
FIFTH SEMESTER							
Zoology-V: ZOO-T5 **Animal Physiology and Endocrinology**	56 hrs	4	3	20	80	100	3
Zoology Practical-V: DSCZOO-P5 **Animal Physiology and Endocrinology**	30 hrs	3	3	10	40	50	2

Zoology-VI: DSCZOO-T6 **Biostatistics and Techniques in Biology**	56 hrs	4	3	20	80	100	3
SKILL-2: COMPULSORY **Applied Zoology-II** **(Title to be confirmed)**	30 hrs	3	3	10	40	50	2
SIXTH SEMESTER							
Zoology-VII: DSCZOO-T7 **Developmental Biology and Environmental Biology**	56 hrs	4	3	20	80	100	3
Zoology Practical-VI: DSCZOO-P6 **Developmental Biology and Environmental Biology**	30 hrs	3	3	10	40	50	2
Zoology-VIII: DSCZOO-T8 **Evolutionary Biology and Behavioural Biology**	56 hrs	4	3	20	80	100	3
SKILL-3: INTERNSHIP	90 hrs	3	2	10	40	50	2

Syllabus for B.Sc., in Zoology

Introduction

The curriculum framework takes into account the need to maintain globally competitive standards of achievement in terms of the knowledge and skills in Zoology and allied courses, as well develop scientific orientation, spirit of enquiry problem solving skills and human and professional values which foster rational and critical thinking in the students. This course serves as plethora of opportunities in different fields right from classical to applied Zoology.

PROGRAM OUTCOMES IN B. Sc Zoology (UG)

- **PO1** - Students gain knowledge and skill in the fundamentals of animal sciences, understands the complex interactions among various living organisms.
- **PO2** – Analyse complex interactions among the various animals of different phyla, their distribution and their relationship with the environment.
- **PO3** – Apply the knowledge of internal structure of cell, its functions in control of various metabolic functions of organisms.
- **PO4** – Understands the complex evolutionary processes and behaviour of animals.
- **PO5** – Correlating the physiological processes and relationship of organ systems.
- **PO6** – Understanding of environmental conservation processes and its importance, pollution control and biodiversity and protection of endangered species.
- **PO7** – Gain knowledge of Agro based Small Scale industries like sericulture, fish farming, butterfly farming and vermicomposting preparation.
- **PO8** – Understands about concepts of genetics and its importance in human health.
- **PO10** – Apply the knowledge and understanding of Zoology to one's own life and work
- **PO11** – Develops empathy and love towards the animals.
- **PO12**– To correlate the relationships among animals, plants and microbes.

Program Specific Outcomes:

- **PSO1**. Understand the nature and basic concepts of cell biology, genetics, taxonomy, physiology, ecology and applied Zoology.
- **PSO2**. Analyse the relationships among animals, plants and microbes.
- **PSO3**. Perform procedures as per laboratory standards in the areas of Taxonomy, Physiology, Ecology, Cell biology, Genetics, Applied Zoology, tools and techniques of Zoology, Toxicology, Entomology, Nematology, Sericulture, Biochemistry, Fish biology, Animal biotechnology, Immunology and research methodology.
- **PSO4**. Understand the applications of biological sciences in Apiculture, Aquaculture, Agriculture and Medicine.
- **PSO5**. Gains knowledge about research methodologies, effective communication and skills of problem-solving methods.
- **PSO6**. Contributes the knowledge for Nation building.

GRADUATE ATTRIBUTES IN B.Sc., Zoology

Some of the characteristic attributes a graduate in Zoology should possess are:

- Develop the essential and fundamental skills required to enter the professional world of animal sciences.
- Tasks, including DNA analysis and trace evidence examination.
- Skilled communication and developing scientific knowledge.
- Critical thinking and problem-solving capacity:
- Ethical awareness / reasoning.

Weightage for assessments

Type of Course	Formative Assessment / IA Marks	Summative Assessment Marks
Theory	**20**	**80**
Practical	**10**	**40**

Outline of the blue-print of Question papers to be prepared. (% of share in each category)

THEORY

- Part – A: Short answer questions: (Answer any 5 out of 8) 5x 2 = 10
- Part – B: Medium size questions: (Answer any 6 out of 8)
  (to test overall understanding of subject): - 6x 5 = 30
- Part – C: Essay type questions: (Answer any 4 out of 6)
  (to test overall understanding of subject): - 4 X 10 = 40

Total Marks: 80

IA marks: 20

Total: 100

PRACTICALS

Total Practical exam Marks: 40

IA marks: 10

Total: 50

IV SEMESTER B.SC., ZOOLOGY THEORY SYLLABUS

THEORY PAPER: CELL BIOLOGY, IMMUNOLOGY AND GENETICS

Program Name:	**B.Sc., Zoology**	**Semester:**	**IV**
Course Title:	**Cell Biology, Immunology and Genetics**		
Course Code:	**DSCZOOT4**	No. of Credits:	**3**
Contact hours:	**56 Hours**	Duration of SEA/Exam:	**3 hrs**
		Hours / Week:	**4 hrs**
Formative Assessment Marks:	**20**	Summative Assessment Marks:	**80**

Course Pre-requisite(s): Outcome

Course Out comes (COs): After the successful completion of the course, the student will be able to:

CO1: understanding of cellular architecture and diversity of prokaryotic and eukaryotic cells.

CO2: Acquire a deep insight on the concepts of cell biology and the ultrastructure of cells, structure and function of organelles.

CO3: Illustrate the phases of cell cycle, cell division, reductional division in germ cells.

CO4: To understand the fundamental concepts of immunology including cells and organs of immune system, immune responses, antibody structure, MHC complex and immunization programme.

CO5: Analyze the principles of genetic inheritance and chromosomal variations in organisms and also achieve competence in undergraduate level problem solving skills relevant to the genetics.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Outcomes (COs)/(POs)	DSCZOO-T4
I Core competency	X
II Critical thinking	X
III Analytical reasoning	X
IV Research skills	X
V Team work	X

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program.

Content	56 Hrs
Unit - I	**14 hrs**
Cell Biology – 1 • Cell: Ultrastructure of Animal Cell.	

• Plasma membrane: Chemical composition, Structure (Fluid mosaic model). • Transport across cell membrane: Passive transport (simple and facilitated diffusion; osmosis) and active transport (Na^+- K^+pump), bulk transport. • Components of Cytoplasm, Ultra structure and functions of Mitochondrion, Golgi apparatus, Endoplasmic reticulum, Ribosomes and Lysosomes. • Ultrastructure and functions of Nucleus. • Structural organization of Chromosome. • Chromatin Organization - Nucleosome model.	
Unit – II	**14 hrs**
Cell Biology – 2 • Base composition and structure of DNA and t-RNA. • Types of DNA; RNA – types and functions. • Cell cycle and its regulation and check points. • Cell division: Meiosis and its significance. • Apoptosis: Definition, pathway and significance. • Cancer Biology: Definition, types with examples, Benign & Malignant, General properties of cancer cells, Carcinogens – Types (Environmental, chemical and biological). Cancer Diagnosis (Biopsy, imaging) and treatment.	
Unit - III	**14 hrs**
Immunology • Definition, types of immunity, First, Second and third line (Role of B and T lymphocytes) of immunity. • Role of APC cells. • Primary and Secondary Immune response. • Functional aspects of organs of the Immune system - Thymus and Bone marrow, Spleen, Lymph Node, Small intestine (Peyer's patches) and Liver (Von Kupffer cells). • Immunoglobulins: Types and functions, Structure of IgG antibody. • Vaccines: Types and Uses - Immunization (BCG, OPV, Hepatitis B, Tetanus, DPT). **Genetics – 1** • Genes and Environment: phenocopy, Norm of reactions (Fur colour in Himalayan Rabbit, human twins). • Mendelian Genetics: Terminologies, Mendelian Laws of inheritance - monohybrid and dihybrid, test cross, back cross. • Incomplete Dominance.	
Unit - IV	**14 hrs**

Genetics – 2 • Sex Determination: a. Chromosomal basis of sex determination: Types with examples b. Environmental sex determination c. Free martins • Patterns of inheritance: Autosomal Dominant (Eg. polydactyly), Autosomal recessive (Eg. Albinism), X-linked Dominant (Eg. Hypophosphatemia) and X-linked recessive (Eg. Duchene muscular dystrophy). • Chromosomal aberrations: Aneuploidy - Autosomal (Down's syndrome and Cri-du-Chat syndrome) and Allosomal (Turner's syndrome and Klinefelter's syndrome). • X – linked inheritance: Eye colour in Drosophila, Colour blindness and Haemophilia in Man. Y – linked inheritance: Hypertrichosis in man. • Human karyotype and Pedigree analysis: Definition, Symbols used in pedigree studies, Pedigree construction and analysis (Problems on polydactyly, albinism, colour blindness and haemophilia in Man).	

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

Formative Assessment for Theory	
Assessment Occasion / type	**Marks**
House Examination/Test	10
Written Assessment/Presentation/Project/Term Papers/Seminars	05
Classroom Performance/Participation	05
Total	**20 Marks**

IV SEMESTER B.Sc., ZOOLOGY PRACTICAL SYLLABUS

PRACTICAL PAPER: CELL BIOLOGY, IMMUNOLOGY AND GENETICS

Program Name:	**B.Sc.**	**Semester:**	**IV**
Course Title:	**Cell Biology, Immunology and Genetics**		
Course Code:	**DSCZOO-P4**	No. of Credits:	**2**
Contact hours:	**30 Hours**	Duration of SEA/Exam:	**3 hrs**
		Hours / Week:	**3 hrs**
Formative Assessment Marks:	**10**	Summative Assessment Marks:	**40**

Course Pre-requisite(s): Outcome

Course Outcomes: After the successful completion of the course, the student will be able to:
CO1: To identify the liver parenchyma cells.
CO2: To prepare stained slides and to observe the different stages of Mitosis and Meiosis.
CO3: To study the chromosomal aberrations and understand the karyotyping analysis
CO4: How chromosomal aberrations are inherited in humans by pedigree analysis in families.
CO5: Solve various genetics problems.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Outcomes (COs)/(POs)	DSCZOO-P4
I Core competency	X
II Critical thinking	X
III Analytical reasoning	X
IV Research skills	X
V Team work	X

Course Articulation Matrix relates course out comes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X 'in the inter section cell if a course outcome addresses a particular program outcome.

Sl. No.	Practical Contents	10 Units
1.	Isolation and observation of buccal epithelial cells or Liver Parenchyma cells.	
2.	Squash preparation to study the different stages of Mitosis in root tip of *Allium cepa.*	

3.	Squash preparation to study the different stages of Meiosis in grasshopper testis or flower buds of *Allium cepa* (virtual/ slides).	
4.	Blood typing in humans.	
5.	Study of human Karyotype: Normal and Abnormal – Down's syndrome, Klinefelter's syndrome, Turner's syndrome, cri-du-chat syndrome.	
6.	Pedigree symbols, pedigree construction and analysis - polydactyly, albinism, colour blindness and haemophilia in Man.	
7.	Genetic problems: Monohybrid cross, Dihybrid cross, multiple alleles, gene interaction.	

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment, Test

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**
House Examination/Test	05
Class Room Performance / Attendance	05
Total	**10 marks**

References:

1. Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A. &
2. Martin, K., (2016). Molecular Cell Biology, 8th ed., W.H. Freeman & Co., New York.
3. Alberts et al: Molecular Biology of the Cell: Garland (2002).
4. Cooper: Cell: A Molecular Approach: ASM Press (2000).
5. Karp: Cell and Molecular Biology: Wiley (2002). Pierce B. Genetics. Freeman (2004).
6. Verma, P.S. and V.K. Agarwal: Genetics, 8th edition, S. Chand & Co, New Delhi (2013)
7. Vimala C.M: Introductory Zoology Vol. V, Interline Publishing, Bangalore. (2006)
8. Dubey: Text book of Biotechnology S. Chand & Co. New Delhi. (2006)
9. Brooker, R.J., (2017). Genetic analysis and principle, 6th ed., Mc Graw Hill.
10. Cooper & Sinauer G.M., (2019). The Cell: A Molecular Approach, International 8th ed.,
11. Powar C.B (2019). Cell Biology 3rd edition. Himalaya Publishing House, Mumbai.
12. Gupta, P.K. (2019) Genetics, 5th Ed., Rastogi Publication, Meerut, India
13. Tamarin, R. (2017). Principles of Genetics, 7th ed., Mc-Graw – Hill Publication.
14. Janis Kuby (2018). Immunology 6th Edition
15. Nandini Shetty (1993) Immunology: Introductory Textbook.
16. Latha, Madhavee P. (2012), A Textbook of Immunology, S. Chand Publishing.

IV SEMESTER B.SC., ZOOLOGY ELECTIVE - 2 SYLLABUS

THEORY PAPER: FOOD, NUTRITION AND HEALTH

Program Name:	**B.Sc.**	**Semester:**	**IV**
Course Title:	**Food, Nutrition and Health**		
Course Code:	**DSEZOO-2**	No. of Credits:	**2**
Contact hours:	**28 Hours**	Duration of SEA/Exam:	**1.5 hrs**
		Hours / Week:	**2 hrs**
Formative Assessment Marks:	**10**	Summative Assessment Marks:	**40**

Course Out comes (COs): After the successful completion of the course, the student will be able to:

CO1: Understand the fundamental concepts of food, nutrition, and their role in maintaining health and diseases.

CO2: Identify essential nutrients, their functions, and the effects of deficiencies.

CO3: Provide culturally competent nutrition services for diverse individuals.

CO4: Explain the digestion, absorption, and metabolism of macronutrients and micronutrients.

CO4: Assess dietary requirements for different age groups and physiological conditions.

CO5: Analyse the relationship between food choices and lifestyle diseases for better health.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Outcomes (COs)/(POs)	DSEZOO-2
I Core competency	X
II Critical thinking	X
III Analytical reasoning	X
IV Research skills	X
V Team work	X

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program.

Content	28 hrs
Unit - I	**14 hrs**
Nutrition and dietary nutrients • Basic concept of Food: Components and nutrients. Concept of balanced diet. • Macronutrients: Carbohydrates, Lipids, Proteins - Definition, Classification, their dietary source and role. • Micronutrients: Vitamins - Water-soluble and Fat-soluble vitamins - their sources and importance. Important minerals, sources and their biological functions - Iron, Calcium, Phosphorus, Iodine, Selenium and Zinc. • Nutrient requirements and dietary pattern for different groups viz., infants, children, adolescents, adults, pregnant, nursing mothers, and elderly people.	
Unit - II	**14 hrs**
Malnutrition and Deficiency diseases • Definition and concept of health: Common nutritional deficiency diseases- Protein Malnutrition (e.g., Kwashiorkor and Marasmus), Disorders due to deficiency of Vit A, Vit B complex, Vit D, Iron and Iodine - their symptoms, treatment, prevention and government initiatives. • Life style disorders: Introduction, types - hypertension, Type II - Diabetes mellitus, sleep disorder, obesity, cancer - causes and prevention. • Social health problems - Smoking, Alcoholism, Drug abuse, AIDS; Treatment and Rehabilitation.	

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

Formative Assessment	
Assessment Occasion / type	**Marks**
House Examination / Test	05
Class room Performance / Participation	05
Total	**10 Marks**

References:

1. Mudambi, S.R. and Rajagopal, M.V. (2007). Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed; New Age International Publishers
2. Srilakshmi, B. (2002). Nutrition Science; New Age International (P) Ltd.
3. Srilakshmi, B. (2007). Food Science; Fourth Ed; New Age International (P) Ltd.
4. Swaminathan, M. (1986). Handbook of Foods and Nutrition; Fifth Ed; BAPPCO.
5. Bamji, M.S.; Rao, N.P. and Reddy, V. (2009). Text Book of Human Nutrition; Oxford & IBH Publishing Co. Pvt Ltd.
6. Wardlaw, G.M. and Hampl, J.S. (2007). Perspectives in Nutrition; Seventh Ed; McGraw Hill.
7. Lakra, P. and Singh M.D. (2008). Textbook of Nutrition and Health; First Ed; Academic Excellence.
8. Manay, M.S. and Shadaksharaswamy, M. (1998). Food-Facts and Principles; New Age International (P) Ltd.
9. Gibney, M.J. et al. (2004). Public Health Nutrition; Blackwell Publishing.

IV SEMESTER B.SC., ZOOLOGY SKILL ENHANCEMENT COURSE
PRACTICAL SYLLABUS
PRACTICAL PAPER: APPLIED ZOOLOGY - 1

Program Name:	**B.Sc.**	**Semester:**	**IV**
Course Title:	**Applied Zoology - 1 (Economic Zoology)**		
Course Code:	**DSE - 1**	No. of Credits:	**2**
Contact hours:	**30 Hours**	Duration of SEA/Exam:	**2 hrs**
		Hours / Week:	**3 hrs**
Formative Assessment Marks:	**10**	Summative Assessment Marks:	**40**

Course Out comes (COs): After the successful completion of the course, the student will be able to:

CO1: Develop hands-on skills in handling and identifying economically important insects, pests, and beneficial animals.

CO2: Develop practical skills in silkworm rearing, mulberry cultivation, cocoon processing and silk production techniques.

CO3: Develop practical skills in the analysis of milk quality and the processing techniques for the production of dairy products.

CO4: Gain practical knowledge of poultry farming, including breed identification, housing, feeding, disease management, and egg/meat production techniques.

CO5: Acquire hands-on skills in aquarium setup, maintenance, and water quality management for sustaining aquatic life.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Out comes (POs)

Course Outcomes (COs)/(POs)	DSE-1
I Core competency	X
II Critical thinking	X
III Analytical reasoning	X
IV Research skills	X
V Team work	X

Course Articulation Matrix relates course outcomes of course with the corresponding program out comes whose attainment is attempted in this course. Mark 'X' in the inter section cell if a course outcome addresses a particular program.

Sl. No.	Practical Contents	10 Units

1.	Sericulture: Introduction, Species of silkmoth, lifecycle of silkmoth, Moriculture, silkworm rearing, post-coocon processing,	
	products and byproducts of sericulture – cocoon, silkfibre and types of silk.	
2.	Apiculture: Introduction, Species of honeybees, caste system, lifecycle, products of apiculture – honey, propolis, beewax.	
3.	Poultry: Introduction, Indigenous and exotic breeds of fowls, Broilers and layers, poultry feeding and nutrition, nutritive value of egg.	
4.	Dairy Products Analysis: a. Detection of density of milk by using lactometer. b. Milk composition and qualitative test – Proteins, fats, lipids, lactose test, Urea test, formalin test, NaCl test. c. Preparation of Curd, butter, buttermilk, ghee, paneer.	
5.	Aquarium Management: a. Freshwater Aquarium setup, aquarium fabrication, ornamental fishes (any 6 fishes to be explained) and aquarium plants (any 4 plants to be explained), fish food and aquarium maintenance. b. Aquarium water Parameter Tests: Use of water testing kits (liquid test kits, test strips); pH levels, Ammonia (NH_3), Dissolved oxygen (DO), Carbon dioxide (CO_2), General hardness (GH).	

Pedagogy: Lectures, Presentations, Videos, Assignments and Weekly Formative Assessment Tests

Note:

1. Maximum number of students in Skill Enhancement Courses (Practical Based) is 15 (Fifteen) and is considered as FULL BATCH with TWO TEACHERS.

2. Field visit / Industrial visit pertaining to the syllabus during the semester is compulsory and the report of this is to be submitted along with practical record as a part of practical examination.

Formative Assessment for Practical	
Assessment Occasion/type	**Marks**
House Examination/Test	05
Class room Performance/Participation	05
Total	**10 Marks**

References:

1. Sathe T.V. Vermiculture and Organic Farming
2. Jabde P.V. (2005) Textbook of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac culture.
3. Eikichi, H. (1999) Silkworm breeding, Oxford and IBH Publishing Co. Pvt Ltd., New

Delhi
4. Ganga, G. (2003). Comprehensive Sericulture Vol II: Silkworm rearing and Silk Reeling. Oxford and IBH Publishing Co. Pvt Ltd., New Delhi
5. Shukla and Updhyaya. (2002). Economic Zoology, Rastogi Publishers
6. Manual of Methods of Analysis of foods; Milk and milk products – Lab Manual: FSSAI. www.fssai.gov.in
7. Yadav Manju (2003). Economic Zoology, Discovery Publishing House.
8. Bard. J (1986) Handbook of Tropical Aquaculture.
9. Applied and Economic Zoology (SWAYAM) https://swayam.gov.in/nd2_cec20_ge23/preview

Duration: 3 hrs
Max. Marks: 40

SCHEME OF PRACTICAL EXAMINATION

IV Semester B.Sc., Zoology
PRACTICAL – IV: CELL BIOLOGY, IMMUNOLOGY AND GENETICS
Course Code: DSCZOO – P4

Duration: 3 hrs
Max. Marks: 40

1.	Isolation of buccal smear.	05 marks
2.	Mitosis / Meiosis – Squash preparation, identification and comment on any one stage.	06 marks
3.	Blood typing.	06 marks
4.	Human karyotype: Identify and comment on A.	05 marks
5.	Genetic problems: (Any Two)	08 marks (2x4=8)
6.	Pedigree construction or analysis (One Problem)	05 marks
7.	Class Records	05 marks
	Total	**40 marks**

Scheme of Valuation

1. Q.1: Performance - **03M**; Principle and diagram – **02M**
2. Mitosis / Meiosis: Performance – **04M**; Comment on the stage – **01M**; diagram – **01M**
3. Q.3: Performance – **03M**; Procedure –**2M;** Result – **01M**

4. Identification – **01M**; Comments – **04M**
5. Genetic problems **–** 04M each (**2 x 4 = 8M**)
6. pedigree construction / analysis **– 05M**

IV Semester B.Sc., Zoology
SKILL ENHANCEMENT COURSE PRACTICAL
APPLIED ZOOLOGY - 1
Course Code: DSE - 1

Duration: 3 hrs
Max. Marks: 40

1.	a. Qualitative analysis of Proteins, fats, lipids, lactose, urea, formalin, NaCl in the given milk sample. (Any three tests) Or b. Preparation of milk product. Comment on the results. Paneer / Ghee / Buttermilk / Butter (Any one)	09 marks (3x3=9) 09 marks
2.	a. Qualitative analysis of Ammonia and pH present in the given aquarium water sample. Discuss the results. Or b. Estimation of Dissolved oxygen / carbondioxide / salinity / hardness in the aquarium water sample. Discuss the results. (Any one)	09 marks
3.	Identify and Comment on the spotters **A** to **C**. (Sericulture / Apiculture / poultry / aquarium management)	09 marks (3x3=09)
4.	Viva - Voce	05 marks
5.	Class Records (04) + Field visit report (04)	08 marks
	Total	**40 marks**

Scheme of Valuation

1. A. Experiment performance – **01M,** procedure – **01M**, result – **01M** (for each test)
   B. Preparation – **05M**, Principle – **01M**, procedure – **02M**, result – **01M**
2. A. For Qualitative Analysis - Experiment performance – **01M,** principle – **01M**, procedure – **01M**, result and discussion – **1 ½ M** (for each test)
   B. Titration Experiment – Principle and Procedure – **04M**; Calculations – **03M;** Results and Discussion – **02M**
3. Spotters: Identification – **01M**; Comments – **02M**
4. **Viva voce – Any 5 questions from the syllabus**

BLUEPRINT FOR ZOOLOGY QUESTION PAPER
Paper III & IV
Course Code – DSCZOO – T3 & T4

Unit	Teaching (hrs)	Number of Questions			Total Marks
		08 (2 Marks)	08 (5 Marks)	05 (10 Marks)	
Unit 1	14	2	2	1.5	29
Unit 2	14	2	2	1.5	29
Unit 3	14	2	2	1.5	29
Unit 4	14	2	2	1.5	29
Total	**56 hrs**	**8x2=16**	**8x5=40**	**6x10=60**	**116**

BLUEPRINT FOR ZOOLOGY ELECTIVE QUESTION PAPER
Elective Paper 1 and 2
Course Code – DSEZOO - 1 & 2

Unit	Teaching (hrs)	Number of Questions			Total marks
		05 (1 marks)	07 (3 marks)	06 (5 marks)	
I	14	03	03	03	27
II	14	02	04	03	29
Total	**28 hrs**	**5x1=05**	**7x3=21**	**06x5=30**	**56**

III & IV Semester B.Sc., Zoology Elective Model Question Paper
Paper: Elective 1 & 2

Time: 1.5 Hrs **Max. Marks: 40**

Instructions to Candidates:
1. All sections/parts are compulsory.
2. Draw neat labelled diagrams wherever necessary.

PART - A

I. Answer the following: (5X1=5)

4. .
5. .
6. .
7. .
8. .

PART - B

II. Answer any FIVE of the following: (5X3=15)

9. .
10. .
11. .
12. .
13. .
14. .
15. .

PART - C

III. Answer any FOUR of the following: (4X5=20)

7. .
8. .
9. .
10. .
11. .
12. .

****