Anekant Education Society's

TULJARAM CHATURCHAND COLLEGE

OF ARTS, SCIENCE & COMMERCE, BARAMATI.

(AUTONOMOUS INSTITUTE)

GRADUATE DEPARTMENT OF ZOOLOGY

SYLLABUS

F. Y. B. Sc. Zoology Part-I,

SEMESTER-I

ACADEMIC YEAR 2022-2023

Anekant Education Society's
TULJARAM CHATURCHAND COLLEGE
OF ARTS, SCIENCE & COMMERCE, BARAMATI.
AUTONOMOUS

Scheme of Course Structure (CBCS) Faculty of Science
Department of Zoology

SEMESTER-I

Class: F.Y.B.Sc. **Pattern: 40 (IA) + 60 (EA)**

Semester	Course Code	Title of Course	No. of Credits
Semester I	USZL111	Animal Systematics and Diversity - I	2
	USZL112	Fundamentals of Cell Biology	2
	USZL113	**Zoology Practical-I**	2
Semester II	USZL121	Animal Systematics and Diversity - II	2
	USZL122	Genetics	2
	USZL123	**Zoology Practical-II**	2

I A* - Internal Assessment

E A*- External Assessment

SYLLABUS (CBCS) FOR F.Y.B.Sc. ZOOLOGY (w. e. f. June, 2022)

Class: F.Y.B.Sc. (Semester – I)
Course Code: USZL111
Course: I **Title of Course: Animal Systematics and Diversity – I**
Credit: 2 **No. of Lectures: 30**

Learning Objectives:-

- Apply the Three Domain & Six Kingdom system to accurately classify diverse animal forms, distinguishing invertebrates from other life forms.
- Explain the importance of animal classification in organizing biological knowledge, facilitating research, and understanding evolutionary relationships.
- Master the Linnaean hierarchy classification system, confidently identifying phyla, classes, orders, families, genera, and species of animals.
- Differentiate between taxonomy and systematics, comprehending basic taxonomic terminology and the levels of alpha, beta, and gamma taxonomy.
- Evaluate the applications of biochemical and molecular methods in contemporary taxonomic research, understanding their advantages and limitations.
- Classify major invertebrate phyla like Protozoa, Porifera, Cnidaria, Platyhelminthes, Aschelminthes, and Annelida based on their salient features and representative examples.
- Analyze the evolutionary trends and adaptations observed within major invertebrate groups, drawing connections between classification and organismal characteristics.

Learning Outcomes:-

Student will be able to-

CO1: Precisely categorize diverse animal forms using the Three Domain & Six Kingdom system, readily distinguishing invertebrates from other life domains and kingdoms.

CO2: Articulate the crucial role of animal classification in organizing biological knowledge, enhancing research, and unveiling evolutionary relationships among animal groups.

CO3: Fluently navigate the Linnaean hierarchy, flawlessly identifying and classifying animals at all taxonomic ranks (phyla, classes, orders, families, genera, and species).

CO4: Clearly differentiate between taxonomy and systematics, demonstrating comprehension of basic taxonomic terminology and confidently apply alpha, beta, and gamma levels of taxonomy.

CO5: Critically evaluate the applications and limitations of biochemical and molecular techniques in modern taxonomic research, providing evidence-based arguments for their use.

CO6: Master the classification of major invertebrate phyla (Protozoa, Porifera, Cnidaria, Platyhelminthes, Aschelminthes, and Annelida) by confidently identifying and describing their distinct features and readily citing representative examples.

CO7: Analyze evolutionary trends and adaptations within major invertebrate groups, establishing a strong connection between classification and the diverse characteristics observed across these animals.

TOPICS / CONTENTS:

Unit	Subunit No	Content	Lectures
1. Principles of animal classification	1.1	Introduction to invertebrates, Three Domain & Six kingdom classification system	**06**
	1.2	Importance of animal classification.	
	1.3	Systematics-Linnaean hierarchy (Phylum, Class, Order,	

		Family, Genus and Species)	
	1.4	Taxonomy-Basic terminology and Introduction : Alpha, Beta and Gamma levels of taxonomy, Micro-taxonomy	
	1.5	Approaches to various taxonomic methods (Biochemical, molecular)	
2. Classification with salient features (Up to class level with minimum one example of each class)	2.1	Protozoa	**06**
	2.2	Porifera	
	2.3	Coelenterata (Cnidaria)	
	2.4	Platyhelminthes	
	2.5	Aschelminthes	
	2.6	Annelida	
3. General topics	3.1	Protozoa: Pathogenic protozoans (Any two)	**06**
	3.2	Porifera: Skeleton	
	3.3	Cnidaria: Coral reefs & Its importance	
4. Type study: *Pheretima posthuma*	4.1	Systematic position, Habits and habitat	**12**
	4.2	Morphology & Hydrostatic skeleton	
	4.3	Digestive system	
	4.4	Circulatory system	
	4.5	Excretory system.	
	4.6	Reproductive system	
	4.7	Nervous system and sense organs.	
	4.8	Regeneration	
	4.9	Economic importance	

REFERENCES:

1. Textbook of Invertebrate Zoology, by Kotpal, RL. Rastogi and Co., Meerut.
2. Phylum Protozoa by Kotpal, RL., Rastogi and Co., Meerut.
3. Phylum Porifera by Kotpal, RL., Rastogi and Co. Meerut.
4. Phylum Coelenterata by Kotpal, RL., Rastogi and Co. Meerut.
5. Phylum Helminthes by Kotpal, RL., Rastogi and Co. Meerut.
6. Phylum Annelida by Kotpal, RL., Rastogi and Co. Meerut.
7. Phylum Platyhelminthes by Kotpal, RL., Rastogi and Co. Meerut.
8. Phylum Arthropoda by Kotpal, RL., Rastogi and Co. Meerut.
9. Phylum Mollusca by Kotpal, RL., Rastogi and Co. Meerut.
10. Phylum Echinodermata by Kotpal, RL., Rastogi and Co. Meerut.
11. Life of Vertebrates by Young, JZ., III Edition, Clarendon Press, London.
12. General Zoology by Goodnight and others IBH Publishing Co.
13. Invertebrate zoology By Jordan EL., and Verma PS., S. Chand and Co., NewDelhi.
14. Life of Invertebrates by Prasad,SN, Vikas Publishing House, New Delhi.
15. Zoology by S.A. Miller and J.P. Harley –Tata McGraw Hill Co.
16. Invertebrates, Richard Brusca, Sinauer Associates, Inc., Sunderland, USA.
17. Invertebrate Zoology by Dhami and Dhami.
18. Biology of the Invertebrates, Jan A. Pechenik, McGraw Hill Education.
19. Role of Earthworms in agriculture by Indian Council of Agricultural Research (ICAR) by Bhatt J.V.& Khambata S.R.

Course Articulation Matrix of USZL111: Animal Systematics & Diversity-I
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	1	2	2	1	1	1	3
CO2	3	2	3	2	2	2	3	3	2
CO3	3	3	1	2	1	1	1	1	2
CO4	3	3	1	3	1	1	1	1	2
CO5	3	3	1	2	1	1	1	1	2
CO6	3	3	1	2	1	1	1	1	2
CO7	2	2	2	2	3	2	2	2	3

PO1: Disciplinary Knowledge
All Course Outcomes are mapped to PO1 because the primary goal of the course is to impart disciplinary knowledge in the field of animal classification. Each CO contributes directly to the acquisition of knowledge about classification systems, Linnaean hierarchy, taxonomic methods, and specific animal classes.

PO2: Critical Thinking and Problem Solving
Every CO involves critical thinking and problem-solving skills. Understanding classification systems, appreciating the significance of animal classification, mastering Linnaean hierarchy, developing taxonomic proficiency, and acquiring classification skills all necessitate the application of critical thinking and problem-solving abilities.

PO3: Social Competence
The course primarily focuses on the biological and scientific aspects of animal classification rather than extensive social aspects. While appreciation for the significance of animal classification has some social relevance, the direct emphasis on social competence is limited in this context.

PO4: Research-related skills and Scientific temper
Proficiency in taxonomic methods (CO4) explicitly involves research-related skills. Mastery of Linnaean hierarchy (CO3) and classification skills (CO5) also contribute to developing a scientific temper by promoting systematic and evidence-based approaches to understanding and categorizing the animal kingdom.

PO5: Trans-disciplinary knowledge
The integrated understanding through type study (CO7) is mapped to trans-disciplinary knowledge as it requires combining knowledge from various disciplines. While other COs are more focused on biological aspects, the integrated understanding component involves a broader, trans-disciplinary approach.

PO6: Personal and professional competence
While some aspects of personal and professional competence are indirectly addressed (e.g., critical thinking and problem-solving), the course does not explicitly focus on personal and professional competence. Therefore, the mapping is partial.

PO7: Effective Citizenship and Ethics
Similar to personal and professional competence, the course does not directly address effective citizenship and ethics. While an appreciation for the significance of animal classification touches upon ethical considerations, the emphasis is not sufficient for a strong mapping.

PO8: Environment and Sustainability

The course does touch upon environmental and sustainability aspects through the appreciation of the significance of animal classification. However, the depth of coverage is not extensive, leading to a partial mapping.

PO9: Self-directed and Life-long learning

Comprehensive understanding of classification systems (CO1) directly contributes to the development of skills necessary for self-directed and life-long learning. The course aims to equip students with the ability to continue learning beyond the classroom setting, particularly in the rapidly evolving field of taxonomy.

SYLLABUS (CBCS) FOR F.Y.B.Sc. ZOOLOGY (w. e. f. June, 2022)

Class: F.Y.B.Sc. (Semester – I)
Course Code: USZL112
Course: II **Title of Course: FUNDAMENTALS OF CELL BIOLOGY**
Credit: 2 **No. of Lectures: 30**

Learning Objectives:-

- Define and differentiate the core concepts of cell biology.
- Master the structure and functions of the cell membrane.
- Understand the organization and properties of the cytoplasm.
- Identify and explain the functions of major cell organelles.
- Appreciate the role and structure of the nucleus and its components.
- Understand the mechanisms and significance of cell division.
- Appreciate the practical applications of cytological techniques in cell biology.

Learning Outcomes:-

Student will be able to-

CO1: Develop a comprehensive understanding of cell biology, including historical perspectives, fundamental theories, and the interdisciplinary nature of the field.

CO2: Critically compare and contrast prokaryotic and eukaryotic cells, as well as plant and animal cells, evaluating size, shape, volume, number, and overall structure.

CO3: Demonstrate a mastery of cell membrane concepts, including its chemical composition, fluid mosaic model, and various functions crucial for cellular processes.

CO4: Acquire in-depth knowledge of cytoplasmic organization, chemical composition, and biological properties, understanding its significance in cellular dynamics.

CO5: Proficient in classifying and describing the structure and functions of major cell organelles, such as the endoplasmic reticulum, Golgi complex, lysosomes, ribosomes, mitochondria, and chloroplast.

CO6: Gain comprehensive insight into the nucleus, covering its characteristics, ultrastructure, and functions. Additionally, they will understand the cell cycle, cell division processes (mitosis and meiosis), and the significance of cell division.

CO7: Apply cytological techniques, specifically centrifugation and density gradient centrifugation, for the separation and analysis of cell organelles, demonstrating practical skills in laboratory settings.

TOPICS / CONTENTS:

UNIT	SUBUNIT NO	CONTENT	LECTURES
01. Introduction to Cell Biology	1.1	Definition and brief history	**(02)**
	1.2	Introduction to cell theory	
	1.3	Scope of Cell Biology	
02. Study of Prokaryotic cell and Eukaryotic cell	2.1	Comparative study of Prokaryotic cell and Eukaryotic cell (Size, Shape, Volume, Number, Structure)	**(01)**
	2.2	Comparative study of plant and animal cell	
03. Structure and functions of cell	3.1	Chemical composition	**(04)**
	3.2	Fluid mosaic model	

membrane	3.3	Functions of cell membrane	
04. Cytoplasm	4.1	Physical Organization	**(02)**
	4.2	Chemical Composition & Biological Properties	
05. Study of cell organelles and their functions	5.1	Endoplasmic reticulum	**(10)**
	5.2	Golgi complex	
	5.3	Lysosomes, Peroxisomes and Glyoxysomes	
	5.4	Ribosomes	
	5.5	Mitochondria	
	5.6	Chloroplast	
06. Nucleus	6.1	Shape, size, number and position	**(03)**
	6.2	Ultrastructure of nucleus	
	6.3	Functions of nucleus	
07. Cell cycle	7.1	Cell cycle in brief	**(06)**
	7.2	Cell division: 1. Mitosis 2. Meiosis	
	7.3	Significance of cell division	
08. Introduction to cytological techniques	8.1	Introduction to Centrifugation & Density Gradient Centrifugation for Separation of Cell organelles	**(02)**

REFERENCES:

1. Cell Biology by Pawar CB, Himalaya Publication House.
2. Cell and Molecular Biology by Dupraw I, Academic Press, New York.
3. Cell Biology by avers, CJ. Addison Wesley Pub. Co. New York and London.
4. Cell and Molecular Biology by Carp, G., JohnWaley, USA.
5. Cell Biology by David, E., Sadava Johnes and Bartlett Publication, London.
6. Cell Structure and Function by Lowey, AG. and Siekevitz, JR., Menninger and Gallew, JAN.,
7. Saunder College Publication, Philadelphia.
8. The Cell by G.M. Cooper - Sinauer Associate Inc.
9. Cell Biology by Arumugamm Saras Publication.
10. Cytology, Genetics and Evolution by P.K. Gupta, Rastogi Publication.
11. Cell Biology by Kotpal.
12. Cell Biology by Swanson
13. Molecular Biology of the Cell, Text book by Bruce Alberts, Garland publishing, Inc. New York and London.
14. Cell and Molecular Biology by Lohar Prakash S. MJP Publishers, Chennai

Course Articulation Matrix of USZL112: FUNDAMENTALS OF CELL BIOLOGY

Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	1	3	2	2	1	1	3
CO2	3	3	1	3	2	2	1	1	2
CO3	3	3	1	3	2	2	1	1	3
CO4	3	2	1	3	2	2	2	1	1
CO5	3	3	1	3	2	2	1	1	2
CO6	3	3	1	3	2	2	1	1	3
CO7	3	3	1	3	2	2	1	1	3

PO1: Disciplinary Knowledge

All course outcomes contribute significantly to the development of disciplinary knowledge in cell biology. Each CO focuses on a specific aspect of cell biology, such as historical understanding, comparative analysis, mastery of concepts, and application of knowledge.

PO2: Critical Thinking and Problem Solving

Each CO requires critical thinking and problem-solving skills. Students need to critically analyze historical perspectives, compare cell structures, understand complex concepts, and apply knowledge to solve problems related to cell biology.

PO3: Social Competence

The primary focus of the course is on biological and cellular aspects rather than on social competence. The course aims to provide a deep understanding of cell biology rather than emphasizing social aspects.

PO4: Research-related skills and Scientific temper

Each CO involves research-related skills, from understanding historical contexts to comparative analysis and application of cell cycle knowledge. The course promotes a scientific temper by requiring students to approach cell biology topics with systematic and evidence-based methods.

PO5: Trans-disciplinary knowledge

While the primary focus is on cell biology, the comparative analysis of cell structures (CO2) could involve knowledge from other disciplines, making it moderately related to trans-disciplinary knowledge.

PO6: Personal and professional competence

Understanding historical context (CO1) and applying knowledge (CO7) indirectly contribute to personal and professional competence. Students develop competence in understanding and applying cell biology concepts.

PO7: Effective Citizenship and Ethics

The course outcomes are primarily focused on cellular biology, and the direct link to effective citizenship and ethics is limited. The emphasis is on scientific understanding rather than societal implications.

PO8: Environment and Sustainability

Similar to effective citizenship and ethics, the course outcomes are not directly related to environmental and sustainability aspects. The primary focus is on cellular and biological processes rather than environmental considerations.

PO9: Self-directed and Life-long learning

All course outcomes contribute to the development of skills necessary for self-directed and life-long learning in the field of cell biology. The diverse topics covered in the course encourage students to continue learning beyond the classroom setting.

SYLLABUS (CBCS) FOR F.Y.B.Sc. ZOOLOGY (w. e. f. June, 2022)

Class: F.Y.B.Sc. (Semester - I)
Course Code: USZL113
Course: III **Title of Course: ZOOLOGY PRACTICAL-I**
(Practicals Corresponding to USZL111, USZL112)
Credit: 2 **No. of Practicals: Any 10**

Learning Objectives:-

- Master fundamental principles of animal classification.
- Gain in-depth knowledge of specific invertebrate groups and their ecological roles.
- Develop practical skills in culturing and managing invertebrates.
- Enhance anatomical knowledge through practical dissection and observation.
- Master basic microscopy techniques and observe microscopic organisms.
- Understand the ultrastructure of key cell organelles and their functions.
- Integrate theoretical knowledge with real-world experience.

Learning Outcomes:-

Student will be able to-

CO1: Demonstrate proficiency in taxonomic classification up to the class level for diverse phyla, including Protozoa, Porifera, Platyhelminthes, Aschelminthes, and Annelida.

CO2: Cultivate and observe animals (Acathamoeba, Hydra, Paramoecium) to understand their life cycles and behaviours.

CO3: Prepare a vermiculture laboratory unit through activity-based learning and comprehend the role of vermiculture in nutrient cycling.

CO4: Develop anatomical proficiency through the dissection of earthworms, gaining insights into their digestive and nervous systems.

CO5: Develop the ability to create accurate scientific drawings of locally available invertebrate specimens from different phyla.

CO6: Understand and apply microscopy techniques, including the Standard Operating Procedure (SOP) for simple and compound microscopes.

CO7: Conduct an ultrastructure study of cellular components (mitochondria, nucleus, endoplasmic reticulum, Golgi complex) and present findings using pictures, models, or charts.

Sr. No.	Title of Practical	Status
1.	Title: Taxonomic classification upto class level 1. Phylum Protozoa 2. Phylum Porifera 3. Phylum Coelenterata	D
2.	Title: Taxonomic classification upto class level 1. Phylum Platyhelminthes- *Taenia, Planaria.*2. Phylum Aschelminthes- *Ascaris, Wuchereria bancrofti. (Filarial worm)*3. Phylum Annelida- *Nereis, Leech.*	D
3.	Culturing of animals (*Acathamoeba*/*Hydra*/*Paramoecium*)	E
4.	Preparation of vermiculture laboratory unit (Activity based learning)	E
5.	Dissection of earthworm so as to learn its digestive and nervous system	E / D
6.	Make scientific drawings of 5 locally available invertebrate specimens belonging to different phyla	E / D
7.	Microscopy: Study of Standard Operating Procedure of a Simple and Compound Microscope.(Activity based Learning)	E
8.	Temporary preparation of a bacterial and protozoans on a slide and its observations under the microscope.	E

9.	Ultrastructure study of: a. Mitochondria b. Nucleus c. Endoplasmic Reticulum d. Golgi complex (With Picture/ Model/ Chart)	D
10.	Study of mitotic cell division using onion root tips	E
11.	Demonstration of mitochondria using Janus Green B stain OR Demonstration of Barr Body	E
12.	Study Tour: Visit to established aquatic ecosystem / functional commercial vermicompost unit and submission of detailed tour report	-
13.	Museum Study: Platyhelminthes, Aschelminthes, Annelida, (one specimen of each	D

***E=Experiment D=Demonstration**

REFERENCES:

1. Practical Zoology of Invertebrates by S. S. Lal.
2. Practical Zoology of Vertebrates by S. S. Lal.
3. Practical Zoology Vol-3 by N Arumugamm and A. Mani.
4. Practical Zoology of Invertebrates by Jordan and Verma.
5. Practical Zoology of Vertebrates by Jordan and Verma.
6. Practical Zoology of Cell Biology by S. S. Lal.
7. *i* Genetics- Molecular Approach, 3rd Ed. by Peter J. Russell, Pearson

Course Articulation Matrix of USZL113: ZOOLOGY PRACTICAL - I

Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	1	3	1	2	1	1	3
CO2	2	3	1	3	1	3	1	2	3
CO3	3	3	1	3	1	3	1	2	3
CO4	1	2	1	2	1	3	1	1	2
CO5	3	3	1	3	1	3	1	2	3
CO6	3	3	1	3	1	3	1	1	3
CO7	3	3	1	3	1	2	1	1	3

PO1: Disciplinary Knowledge

All course outcomes directly contribute to the development of disciplinary knowledge in the field of biological sciences. Each CO focuses on a specific aspect of biology, from taxonomic classification to practical application of techniques, microscopy expertise, and ultrastructure analysis.

PO2: Critical Thinking and Problem Solving

Each CO requires critical thinking skills. Whether it's taxonomic classification, practical application of techniques, or analysis of cellular structures, students are consistently engaged in critical thinking and problem-solving exercises.

PO3: Social Competence

The course primarily focuses on technical and scientific aspects of biology, and the direct link to social competence is limited. The emphasis is on acquiring practical skills and knowledge in the biological sciences.

PO4: Research-related skills and Scientific temper

All COs involve research-related skills, ranging from taxonomic work to practical applications and microscopy. The course promotes a scientific temper by instilling a systematic and evidence-based approach to biological studies.

PO5: Trans-disciplinary knowledge

The course is more specialized in biological sciences, and the trans-disciplinary link is limited. While there may be some overlap, the primary focus is on the core principles and practices within the discipline.

PO6: Personal and professional competence

Each CO contributes to personal and professional competence. From mastering laboratory techniques to developing microscopy expertise and practical application skills, students gain competencies relevant to a professional setting.

PO7: Effective Citizenship and Ethics

The course is primarily centered around biological and laboratory skills, and the direct link to effective citizenship and ethics is limited. The emphasis is on technical proficiency and knowledge acquisition.

PO8: Environment and Sustainability

While not all COs directly address environmental and sustainability aspects, some, like practical application of techniques and microscopy expertise, may have implications for sustainability. The link is moderate and depends on specific applications.

PO9: Self-directed and Life-long learning

Each CO promotes self-directed and life-long learning. The nature of the biological sciences, with its rapidly evolving knowledge base, requires students to develop the skills necessary for continuous learning beyond the classroom setting.