

Anekant Education Society's

TULJARAM CHATURCHAND COLLEGE
OF ARTS, SCIENCE & COMMERCE, BARAMATI.
(AUTONOMOUS INSTITUTE)



तुळजाराम चतुरचंद महाविद्यालय, बारामती
GRADUATE DEPARTMENT OF ZOOLOGY

SYLLABUS

FIRST YEAR B. Sc. Zoology
ACADEMIC YEAR 2022-2023
SEMESTER-II

**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-II

Class: F.Y.B.Sc.

Pattern: 40 (IA) + 60 (EA)

Semester	Course Code	Title of Course	No. of Credits
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**

तुळजाराम चतुर्चंद महाविद्यालय, बारामती

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

Class: F.Y.B.Sc. (Semester – II)

Course Code: USZL121

Course: I

Title of Course: Animal Systematics and Diversity – II

Credit: 2

No. of Lectures: 30

Learning Objectives:-

- Differentiate the key characteristics and classify Hemichordata, Urochordata, and Cephalochordata up to the order level.
- Compare and contrast the general characters of Cyclostomata, Pisces (Chondrichthyes and Osteichthyes), and Amphibia up to the order level, providing one example from each group.
- Analyze the affinities (relationships) of Hemichordata to other animal groups.
- Explain the phenomenon of retrogressive metamorphosis in Urochordata and its significance.
- Describe the migratory patterns of Pisces, highlighting the factors influencing their movement.
- Discuss Neoteny in Amphibia, its evolutionary implications, and its role in the development of specific characteristics.
- Identify and explain the external features and sexual dimorphism of a frog.

Learning Outcomes:-

After completion of this course students will be able to-

CO1: explain how the presence or absence of pharyngeal slits, notochord, and dorsal nerve cord differentiates Hemichordata, Urochordata, and Cephalochordata.

CO2: compare the adaptations for filter feeding in a Cephalochordate (Branchiostoma) and a Urochordate (Ascidia), highlighting the similarities and differences in their feeding mechanisms.

CO3: analyze the potential evolutionary relationships of Hemichordata to other invertebrate groups, considering shared characteristics and fossil evidence.

CO4: discuss the potential advantages and disadvantages of retrogressive metamorphosis in Urochordata, including its impact on reproduction and survival.

CO5: identify the major migratory routes of a specific fish species (e.g., salmon), explaining the environmental factors influencing their movement patterns.

CO6: evaluate the role of Neoteny in the evolution of specific amphibian features like paedomorphism and limb reduction, considering its ecological and developmental implications.

CO7: distinguish between the mating calls of male and female frogs within a specific species, explaining how these calls function in reproductive behaviour.

TOPICS:

Unit No.	Subunit No	Details
1. General characters and classification up to order level with one example from following: (6L)	1.1	Hemichordata
	1.2	Urochordata
	1.3	Cephalochordata
	2.1	Cyclostomata

2. General characters up to order level with one example from following: (6L)	2.2	Pisces - (Chondrichthyes and Osteichthyes)
	2.3	Amphibia
3. General topics: (14L)	3.1	Hemichordata: Affinities
	3.2	Retgressive metamorphosis in Urochordata
	3.3	Pisces: Migration
	3.4	Neoteny in Amphibia
4. Type study of animal: Frog (4L)	4.1	General classification, habit and habitat
	4.2	External characters and sexual dimorphism
	4.3	Sense organs (Eye, ear and skin)
	4.4	Digestive system (Food, feeding and physiology of digestion)
	4.5	Circulatory system (Lymphatic system not expected)
	4.6	Central nervous system (Brain and spinal cord)
	4.7	Reproductive systems (Male & female)

REFERENCES

1. Ganguly, BB., Sinha, A.K., Adhikari, S. (2021). Biology of Animals. New Central Book Agency, Kolkata.
2. Prasad, S. N., & Kashyap, V. (2020). A Textbook of Vertebrate Zoology. New Age International.
3. Dr. A. E. Desai and Dr. K. R. Pawar. (2017). Animal systematics and diversity – I & II.
4. Crane, R. (2015). Creating Parker and Haswell's' A textbook of zoology' (1897). Script & Print, 39(4), 221-240.
5. Verma, P. S. (2013). Chordate zoology. S. Chand Publishing.
6. Lal, S. S. (2009). Practical Zoology Vertebrate. Rastogi Publications.
7. J.R.B. Alfred and Ramakrishna. (2004). Collection, Preservation and Identification of animals. Zoological Survey of India Publications.
8. Bhamrah, MS., Juneja, K. (2003). Introduction to Amphibia. Amol Publication, Delhi.
9. Nigam HC. And Sobti, R., S. Chand and Co. New Delhi (2000). Functional Organization of chordates (part I and II).
10. Mayr, E. (1998). This is biology: The science of the living world. Universities Press.
11. Kershaw, DR., Redwood Burn Ltd., Trowbridge. (1983). Animal Diversity.
12. Vidyarthi. (1968). Textbook of Zoology. Agrasia Publishers, Agra.
13. Goodnight and others IBH Publishing Co. (1964). General Zoology.
14. Young, JZ. (1907). Life of Vertebrates. III Edition, Clarendon Press, London.

Course Articulation Matrix of USZL: 121: Animal Diversity – II

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

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

PO1 – Disciplinary Knowledge:

All COs are highly aligned with this PO as they involve detailed knowledge of specific phyla, evolutionary relationships, and ecological concepts.

PO2 - Critical Thinking and Problem Solving:

Most COs require critical thinking skills, especially in understanding evolutionary relationships (CO3) and discussing advantages and disadvantages (CO4).

PO3 - Social Competence:

CO1 and CO7 involve understanding social behaviors in specific species, aligning with social competence.

PO4 - Research-related skills and Scientific temper:

CO1, CO3, and CO5 involve analyzing and interpreting scientific information, aligning with research-related skills.

PO5 - Trans-disciplinary knowledge:

CO5 involves understanding migratory routes, which can be considered trans-disciplinary as it relates to ecology and environmental factors.

PO6 - Personal and professional competence:

CO6 involves evaluating the role of neoteny, linking personal and professional competence with understanding evolutionary processes.

PO7 - Effective Citizenship and Ethics:

While not explicitly stated, understanding the ecological impact of migration (CO5) and the consequences of metamorphosis (CO4) may touch on ethical considerations.

PO8 - Environment and Sustainability:

CO5 directly involves understanding environmental factors influencing migration patterns.

PO9 - Self-directed and Life-long learning:

Most COs involves continuous learning, especially as the fields of biology and ecology are dynamic.

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

Class: F.Y.B.Sc. (Semester – II)

Course Code: USZL122

Course: II

Credit: 2

Title of Course: GENETICS

No. of Lectures: 30

Learning Objectives:-

- Explain the fundamental principles of genetics, including basic concepts, Mendelian inheritance, and testing for heredity.
- Analyze the significance of multiple alleles and polygenic inheritance, with a focus on ABO & Rh blood groups and their medico-legal implications.
- Differentiate between co-dominance and incomplete dominance, and apply these concepts to analyze gene interaction scenarios involving complementary, supplementary, and inhibitory factors.
- Describe the structure and function of chromosomes, including their classification based on centromere position and types (autosomes, sex chromosomes), and highlight special types like polytene and lampbrush chromosomes.
- Explain the different mechanisms of sex determination (XX-XY, ZZ-ZW, XX-XO, Haploid-Diploid) and discuss phenomena like parthenogenesis, gynandromorphism, and environmental sex determination.
- Identify *Drosophila* as a model organism in genetic studies, analyze its morphology, sexual dimorphism, and life cycle, and explore various eye, wing, and body color mutants.
- Interpret human karyotypes, identify common syndromes like Down's, Klinefelter's, and Turner's, and understand the concept of inborn errors of metabolism as exemplified by albinism and phenylketonuria. Additionally, emphasize the importance of genetic counselling in human health.

Learning Outcomes:-

After completion of this course, students will be able to-

- CO1: Improved understanding of genetic diseases: By identifying the genes and mechanisms behind various diseases, researchers can develop better diagnostic tools, treatments, and preventative measures.
- CO2: Enhanced personalized medicine: Analyzing an individual's genetic makeup can lead to personalized treatment plans based on their unique response to medications and therapies.
- CO3: Advancements in gene editing technologies: CRISPR and other gene editing tools offer the potential to correct genetic mutations and treat diseases at their root cause.
- CO4: More informed reproductive choices: Genetic counseling can help couples understand their risk of passing on genetic conditions to their children, enabling them to make informed decisions about family planning.
- CO5: Increased agricultural productivity: Understanding the genetic basis of crop traits can lead to the development of more resilient and productive crops, contributing to global food security.
- CO6: Deeper understanding of human evolution and diversity: Studying the genetic variations within and between populations can shed light on human evolution, migration patterns, and the origins of complex traits.
- CO7: Improved forensic science: DNA analysis plays a crucial role in criminal investigations, helping to identify suspects, solve cold cases, and exonerate the wrongfully accused.

TOPICS:

UNIT NO.	SUBUNIT NO.	DETAILS
1. Introduction to genetics (3 L)	1.1	Basic concepts in genetics
	1.2	Mendelian Laws of Inheritance and their practical applications
	1.3	Test of heredity
2. Multiple Alleles and Polygenic Inheritance (5 L)	2.1	Concept, characteristics and importance of multiple alleles, ABO & Rh-blood group system and its medico-legal importance
	2.2	Pleiotropism and sickle cell anaemia.
3. Gene Interaction (4 L)	3.1	Concept of gene interaction, co-dominance and incomplete dominance
	3.2	Complementary factors (9:7)
	3.3	Supplementary factors (9:3:4)
	3.4	Inhibitory factors (13:3)
4. Chromosomes (5 L)	4.1	Introduction to morphology and composition
	4.2	Classification based on the centromeric position
	4.3	Types of chromosomes (autosomes and sex chromosomes) Special type of chromosomes: Polytene chromosome - salivary gland chromosome in <i>Drosophila</i> , Lampbrush chromosome in amphibian oocyte
	4.4	Chromosomal aberrations: Structural and numerical changes
5. Sex- determination (4 L)	5.1	Introduction
	5.2	Chromosomal theory of sex determination (XX-XY, ZZ-ZW, XX-XO & Haploid- Diploid method)
	5.3	Parthenogenesis and Gynandromorphism
	5.4	Environmental sex determination
6. <i>Drosophila</i> as Genetic model organism (2 L)	6.1	Morphology, sexual dimorphism and life cycle
	6.2	Mutants: eye, wings and body colour (Two mutants of each type)
7. Human genetics(5 L)	7.1	Study of human karyotype
	7.2	Syndromes: a) Autosomal-Down's (Mongolism) b) Sex chromosomal abnormalities in human: Klinefelter's and Turner's syndrome
	7.3	Inborn errors of metabolism: Albinism and Phenylketonuria

	7.4	Genetic counselling and its importance
8. Sex linked inheritance inhuman (2 L)	8.1	Inheritance of colour blindness, Haemophilia and Hypertrichosis

REFERENCES

1. Russell, P. J., Hertz, P. E., McMillan, B., & Benington, J. (2020). *Biology: the dynamic science*. 3rd edition.
2. Snustad, D. P., & Simmons, M. J. (2015). *Principles of genetics*. 6th edition John Wiley & Sons.
3. Verma, P. S., & Agarwal, V. K. (2009). *Genetics, 9th edition (Multicolour Edition)*. S. Chand Publishing.
4. Klug, W. S., Cummings, M. R., Spencer, C. A., Palladino, M. A., & Ward, S. M. (2009). *Concepts of genetics* 9th edition.
5. Simmons, M. J., & Snustad, D. P. (2006). *Principles of genetics*. John Wiley & Sons. 8th edition.
6. Watson, J. D., Baker, T. A., Gann, A., Bell, S. P., Levine, M., & Losick, R. M. (2004). *Molecular biology of the gene*. 5th edition.
7. Verma, P. S., & Agarwal, V. K. (2004). *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*.
8. Gupta, P. K. (2000). *Genetics*. Rastogi publications
9. Dnyansagar, V. R. (1986). *Cytology and genetics*. Tata McGraw-Hill.

Course Articulation Matrix of USZL: 122: Genetics

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

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

PO1: Disciplinary Knowledge:

Each CO involves gaining in-depth understanding of genetic concepts, diseases, and technologies.

PO2: Critical Thinking and Problem Solving:

Analyzing complex genetic data, formulating hypotheses, and evaluating potential solutions for genetic diseases require critical thinking skills. CO4 necessitates critical analysis of genetic risks and making informed decisions based on evidence. CO6 involves drawing conclusions from genetic variations and understanding their implications for human evolution.

PO3: Social Competence:

CO4 emphasizes effective communication with individuals and families regarding genetic risks and options. CO5 involves collaboration with farmers and agricultural researchers to develop improved crops. CO7 requires clear and concise communication of DNA evidence in forensic investigations.

PO4: Research-related skills and Scientific temper -

All COs involve research activities like data analysis, hypothesis testing, and interpretation of results. All COs requires a scientific approach to genetic studies, emphasizing objectivity and evidence-based conclusions.

PO5: Trans-disciplinary knowledge:

CO3 involves understanding connections between gene editing technologies and other fields like medicine and ethics. CO5 necessitates integrating genetic knowledge with agricultural science for crop improvement. CO6 bridges the gap between genetics and anthropology, contributing to a broader understanding of human diversity.

PO6: Personal and professional competence:

Each CO requires self-directed learning, critical thinking, and problem-solving skills to successfully complete tasks and projects. PO6 emphasizes teamwork and collaboration, which are relevant to COs involving interaction with various stakeholders.

PO7: Effective Citizenship and Ethics:

CO4 necessitates ethical considerations in genetic counselling and respecting individual choices. CO6 involves understanding the ethical implications of genetic research and its impact on society. CO7 requires upholding ethical standards in forensic investigations and ensuring fair outcomes.

PO8: Environment and Sustainability:

CO5 focuses on developing sustainable agricultural practices through genetic engineering, contributing to environmental protection and food security.

PO9: Self-directed and Life-long learning:

Each CO requires continuous learning and adaptation to keep pace with advancements in genetics and related fields. PO9 emphasizes the importance of lifelong learning for professional success and personal growth in the field of genetics.



तुळजाराम चतुरचंद महाविद्यालय, बारामती

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

Class: F.Y.B.Sc. (Semester - II)

Course Code: USZL123

Course: III

Credit: 2

Title of Course: ZOOLOGY PRACTICAL-II

No. of Practicals: Any 10

Learning Objectives:-

- Classify and explain the taxonomic position of five animal groups: Hemichordata (*Balanoglossus*), Urochordata (*Hardmania*), Cephalochordata (*Amphioxus*), Cartilaginous fish (*Scoliodon*), and Bony fish (Sea horse).
- Analyze and understand the structure and function of fish scales and chromatophores.
- Perform a morphometric study of a freshwater fish, including measuring body length, standard length, weight, and analyzing the length-weight relationship.
- Dissect and identify the morphological and anatomical features of a preserved frog specimen, focusing on external characters, sexual dimorphism, the digestive system, and the brain.
- Collect, photograph, and identify five different animals based on their morphological characteristics, linking them to previous practical exercises.
- Research and present profiles of two influential geneticists, highlighting their contributions to the field.
- Analyze human blood groups (ABO and Rh-factor) and solve problems related to monohybrid, dihybrid crosses, and ABO blood groups.

Learning Outcomes:-

Student will be able to-

- CO1: Classify animal groups based on morphological characteristics and link them to their evolutionary relationships. (Hemichordata, Urochordata, Cephalochordata, Cartilaginous fish, Bony fish)
- CO2: Analyze the structure and function of fish scales and chromatophores, relating them to adaptation and survival.
- CO3: Conduct a morphometric analysis of a freshwater fish, interpreting the data and calculating the length-weight relationship for health assessment.
- CO4: Dissect a preserved frog specimen, identifying and explaining the functions of key anatomical features, including sexual dimorphism.
- CO5: Collect and identify five different animals in your local environment based on their morphological characteristics, linking them to previous taxonomic exercises.
- CO6: Present a profile of a prominent geneticist, highlighting their contributions to the field and their impact on our understanding of heredity.
- CO7: Solve genetic problems involving monohybrid and dihybrid crosses, applying the principles of dominant and recessive alleles to predict blood group inheritance in humans (ABO and Rh-factor).

PRACTICALS:

Practical no.	Name of the practical	E/D
1	To study the classification with reasons of the following: I. Hemichordata- <i>Balanoglossus</i> II. Urochordata- <i>Hardmania</i> III. Cephalochordata- <i>Amphioxus</i> IV. Cartilaginous fish- <i>Scoliodon</i> V. Bony fish- Sea horse	D

2	Study of fish scales and chromatophores.	E
3	Morphometric study of any freshwater fish: Measurements of body length, standard length, weigh and length-weight relationship.	E
4	Study and demonstration of morphological and anatomical structures of preserved frog specimen a) Study of external characters, sexual dimorphism. b) Digestive system and brain of frog.	D
5	Collection of any five animals, their photographic images, their morphological characters and identification from practical 01. (Activity based learning)	-
6	Study of human genetic disorders (any two) hereditary disorders / inborn errors of metabolism.	D
7	Profile of Any two Geneticists (Activity based learning) .	-
8	Study of human blood groups: ABO and Rh- factor.	E
9	Genetical Problems: Based on Monohybrid, Dihybrid Cross & ABO Blood Groups.	E
10	Study of Karyotype: Study of normal human karyotype and one abnormal karyotype (any one of Down's Klinefelter's or Turner's from metaphase chromosomal spread picture (image based learning).	E
11	Study of human genetical traits: Tongue rolling, widow's peak, ear lobes, colour blindness and PTC tasters/ non tasters (video based practical).	D
12	Study of <i>Drosophila</i> : A) Culture of <i>Drosophila</i> B) External Characters, Sexual Dimorphism and life cycle. C) Mutants: Eye and wing mutants (any two of each).	D
13	A visit to natural habitat for biodiversity study or Study visit to a research institute or a zoo and submission of report is essential.	-

*E=Experiment, D=Demonstration

REFERENCES:

1. Practical Zoology of Vertebrates by S. S. Lal.
2. Practical Zoology of Vertebrates by Jordan and Verma.

Course Articulation Matrix of USZL: 123: Zoology Practical-II

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

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

PO1: Disciplinary Knowledge:

CO1, CO2, CO3, CO4 are directly assess knowledge of anatomy, morphology, evolution, and adaptation in the animal kingdom. They require students to understand key concepts and theories within the field of zoology. CO5 and CO6 involve applying taxonomic knowledge to real-world scenarios, identifying animals in their environment, and understanding the contributions of prominent geneticists.

PO2: Critical Thinking and Problem Solving:

CO3: Analyzing morphometric data and calculating the length-weight relationship requires critical thinking skills to interpret data and draw conclusions about fish health.

CO7: Solving genetic problems involving crosses necessitates critical thinking about allele inheritance patterns and predicting outcomes.

PO3: Social Competence:

CO5: Identifying and presenting animals in a local environment can involve communication and collaboration with others, fostering social competence. CO6: Presenting a profile on a geneticist can involve research, communication, and presentation skills, contributing to social competence development.

PO4: Research-related skills and Scientific temper:

CO3: Conducting a morphometric analysis involves research skills like data collection, analysis, and interpretation, promoting scientific inquiry. CO4, CO5: Dissecting a frog and identifying animals requires meticulous observation, data collection, and analysis, fostering scientific temper.

PO5: Trans-disciplinary knowledge:

CO6, CO7: Linking genetics to human blood group inheritance demonstrates the application of genetic principles to understand human health, showcasing trans-disciplinary knowledge.

PO6: Personal and professional competence:

CO2, CO3, CO4: Dissection, morphometric analysis, and interpreting data require attention to detail precision, and time management, building personal competence. CO6, CO7: Research, presentation, and problem-solving activities enhance critical thinking and communication skills, contributing to professional competence.

PO7: Effective Citizenship and Ethics:

CO5, CO6: Identifying animals and appreciating their diversity in the local environment can foster environmental awareness and responsible citizenship. CO7: Understanding genetic principles and their implications for human health can promote ethical considerations in research and healthcare.

PO8: Environment and Sustainability:

CO5: Identifying animals in your local environment can contribute to understanding their ecological roles and importance in maintaining biodiversity.

PO9: Self-directed and Life-long learning:

All COs require independent learning, research, and analysis, promoting self-directed learning. CO6: Learning about a prominent geneticist can inspire an interest in lifelong learning and scientific exploration.