

**DEBRA THANA SAHID KSHUDIRAM SMRITI MAHAVIDYALAYA
(AUTONOMOUS)**

Chakshyampur, Debra, Paschim Medinipur, West Bengal



**Syllabus for the UNDERGRADUATE Programme In
ZOOLOGY**

Under NEP 2020

W.e.f. 2025-2026

Debra Thana Sahid Kshudiram Smriti Mahavidyalaya
(Autonomous)

Semester-III

Course Structure

Sl. No.	Name of the Courses	No. of Papers	Credits	Full Marks
1	Major	02	08 (4+4)	150 (75x2)
2	Minor	01	04	75
3	IDC/MDC	01	03	50
4	AEC (Beng./ Hindi)	01	02	50
5	SEC	01	03	50
<i>Total</i>		<i>06</i>	<i>20</i>	<i>375</i>

Debra Thana Sahid Kshudiram Smriti Mahavidyalaya (Autonomous)

Curriculum for Undergraduate in Zoology

[NEP 2020]

Semester-III

Paper Code	Name of the Subject	Nature	Teaching Scheme in hour per week			Credit	Marks
			L	T	P		
UG/III/ZOO/4/MJ-3	MJ-3T: Systematics & Taxonomy	Major Course	3	0	0	4	75
	MJ-3P: Systematics & Taxonomy (Practical)	Major Course	0	0	1		
UG/III/ZOO/4/MJ-4	MJ-4T: Ecology	Major Course	3	0	0	4	75
	MJ-4P: Ecology (Practical)	Major Course	0	0	1		
UG/III/ZOO/4/SE-3P	SE-3P: Apiculture (Practical)	SEC	0	0	3	3	50
UG/III/ZOO/4/MI-3	MI-3T: Ecology	Minor Course	3	0	0	4	75
	MI-3P: Ecology (Practical)	Minor Course	0	0	1		

L= Lecture, T=Tutorial, P=Practical

Major 03: Systematics & Taxonomy

Credits: 04

Major 03T: Systematics & Taxonomy

Credits: 03

Course objectives and expected outcome

This course introduces the science of taxonomy and systematics, exploring the methods and principles used to classify and naming organisms. It covers the history, principles, and methodologies of systematics, including morphological and molecular techniques, and phylogenetic analysis. The course will also discuss the importance of taxonomy and systematics in understanding biodiversity, evolution, and conservation.

Course Contents:

Sl. No.	Topics	Allotted Lecture
1.	Unit 1: Introduction to Taxonomy and Systematics <ul style="list-style-type: none">• Overview of taxonomy & systematics• Historical perspective and the significance of taxonomy in biological sciences.• Taxonomic character	5
2.	Unit 2: The Species Concept <ul style="list-style-type: none">• Different species concepts (biological, morphological, evolutionary, phylogenetic).• Challenges and debates in defining species. Cryptic species, ring species, agamospecies.	10
3.	Unit 3: Taxonomic Hierarchy and Nomenclature <ul style="list-style-type: none">• Rules and conventions (ICZN).• Binomial nomenclature, typification, and the role of museums.	6
4.	Unit 4: Morphological Techniques in Taxonomy <ul style="list-style-type: none">• Traditional morphological methods for classification.• Importance of morphological traits in different groups	4
5.	Unit 5: Molecular Systematics <ul style="list-style-type: none">• Karyotaxonomy, Cytotaxonomy, Biochemical taxonomy• Application of DNA barcoding in taxonomy.• Molecular markers and their applications in systematics	10
6.	Unit 6: Phylogenetics: Principles and Methods <ul style="list-style-type: none">• Phylogenetic trees: types, UPGMA & Maximum Parsimony• Methods of phylogenetic analysis (cladistics, phenetics).	10
Suggested Readings: <ul style="list-style-type: none">➤ Mayr, E. (1942). <i>Systematics and the Origin of Species: From the Viewpoint of a Zoologist</i>. New York: Columbia University Press.➤ Mayr, E., & Ashlock, P. D. (1991). <i>Principles of Systematic Zoology</i> (2nd ed.). New York: McGraw-Hill.➤ Hillis, D. M., Moritz, C., & Mable, B. K. (Eds.). (1996). <i>Molecular Systematics</i> (2nd ed.). Sunderland, Massachusetts: Sinauer Associates.➤ Kapoor, V. C. (2001). <i>Principles of Taxonomy</i>. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.➤ Quicke, D. L. J. (1993). <i>Principles and Techniques of Contemporary Taxonomy</i>. London: Blackie Academic & Professional.		

Major 03P: Systematics & Taxonomy (Practical)**Credits: 01****Course Contents:**

1. Type study and identification: Typification and identifying different organisms.
2. Preparation of Dichotomous Keys
3. Construction of phylogenetic tree: UPGMA, Parsimony
4. Phylogenetic analysis software: Practical use of various computational tools. Case studies using tools/software like CLUSTALW, MEGA

Major 04: Ecology**Credits: 04****Major 04T: Ecology****Credits: 03****Course objectives and expected outcome**

This course introduces the basics of ecosystem structure, composition, and significance. This study provides information about factors affecting the population and community. Developed environmental monitoring skills, including conduct of experiments and data analysis. It also teaches about the significance of wildlife, the threatened category, and the conservation strategy of wildlife animals in an ecosystem.

Course Contents:

Sl. No.	Topics	Allotted Lecture
1.	Unit 1: Introduction to Ecology <ul style="list-style-type: none"> • History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of physical factors, Atmosphere, Hydrosphere and Biosphere, Biome. • Concept of Habitat & Niche: Definition, Type & example; niche overlap and segregation. 	6
2.	Unit 2: Population <ul style="list-style-type: none"> • Unitary and Modular populations • Unique and group attributes of population: Demographic factors, lifetable, fecundity table, • Survivorship curves, dispersal and dispersion. • Geometric, exponential and logistic growth, equation and patterns, r and k strategy, Populations • Population regulation: Density dependent and independent factors • Population Interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition and elimination. 	18

3.	Unit 3: Community <ul style="list-style-type: none"> Community characteristics: species diversity, abundance, dominance, richness Vertical stratification, Ecotone and edge effect, Ecological succession with examples 	11
4.	Unit 4: Ecosystem <ul style="list-style-type: none"> Definition and types of ecosystems with example, Food chain: Detritus and grazing food chains, Food web. Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies. Nutrient and biogeochemical cycle, Nitrogen cycle, Carbon cycle Human modified ecosystem 	10
5.	Unit 5: Applied Ecology <ul style="list-style-type: none"> Wildlife conservation (in-situ and ex-situ conservation) Conservation priorities and the identification of keystone species, umbrella species, flagship species, indicator species. Management strategies for tiger conservation; Wildlife Protection Act (1972) 	5
Suggested Readings: <ul style="list-style-type: none"> ➤ Krebs, C. J. (2001). <i>Ecology: The Experimental Analysis of Distribution and Abundance</i> (5th ed.). San Francisco: Benjamin Cummings. ➤ Odum, E. P. (2008). <i>Fundamentals of Ecology</i> (5th ed., Indian ed.). New Delhi: Cengage Learning India / Brooks-Cole. ➤ Smith, R. L. (1974). <i>Ecology and Field Biology</i> (2nd ed.). New York: Harper & Row Publishers. ➤ Stiling, P. (2001). <i>Ecology: Theories and Applications</i> (4th ed.). Upper Saddle River, New Jersey: Prentice Hall. ➤ Cain, M. L., Bowman, W. D., & Hacker, S. D. (2011). <i>Ecology</i> (3rd ed.). Sunderland, Massachusetts: Sinauer Associates. ➤ Begon, M., Harper, J. L., & Townsend, C. R. (2006). <i>Ecology: From individuals to ecosystems</i> (4th ed.). Oxford: Blackwell Publishing. 		

Major 04P Ecology (Practical)

Credits 01

Course contents:

1. Determination of population density in a natural/hypothetical community by Quadrature method and calculation of Shannon-Weiner diversity index for the same community
2. Study of an aquatic ecosystem: Phytoplankton and zooplankton, determination of pH, and dissolved oxygen content (Winkler's method) and free CO₂.
3. Field Report on Costal Ecosystem/ Zoo Garden/ National Park/ Wildlife Sanctuary/ Biosphere Reserve.

SE03: Apiculture

Credits: 03

SE03P: Apiculture (Practical)

Credits: 03

Course objectives and expected outcome

The student will be able to understand the basics of beekeeping tools, equipment, and managing beehives; understand the primary life cycle of the honeybees; learn and manage beehives for honey production and pollination; understand the marketing of various bee products. The course will be useful for providing self-employment to the learner.

Course Contents:

Sl. No.	Topics	Allotted Practical
1.	Unit 1: Biology of Bees <ul style="list-style-type: none">History, classification and biology of honey beesSocial organization of bee colonyThe process of production of honey	3
2.	Unit 2: Rearing of Bees <ul style="list-style-type: none">Artificial bee rearing (Apiary), Beehives – Newton and LangstrothBee pasturageSelection of bee species for apicultureBee keeping equipmentsMethods of extraction of honey (Indigenous and Modern)Dissect and display- sting apparatus, hind leg	5
3.	Unit 3: Diseases and Enemies <ul style="list-style-type: none">Bee diseases and enemies: control and preventive measures	2
4.	Unit 4: Bee Economy <ul style="list-style-type: none">Products of apiculture industry and its uses (Honey, Bees Wax, Propolis)	4
5.	Unit 5: Entrepreneurship in Apiculture <ul style="list-style-type: none">Bee Keeping Industry – Recent Efforts, Modern methods in employing artificial beehives for cross pollination in horticultural gardens	6
6.	Unit 6: Visit to an Apiculture farm and study the following aspects: <ul style="list-style-type: none">Construction of bee hivesIdentification of bee caste, enemies (Uzi fly)Extraction of honeyPreservation of honey	3

Suggested Readings:

- Prost, P. J. (1962). *Apiculture*. New Delhi: Oxford & IBH Publishing Co.
- Bisht, D. S. (1993). *Apiculture*. New Delhi: Indian Council of Agricultural Research (ICAR).
- Singh, S. (1962). *Beekeeping in India*. New Delhi: Indian Council of Agricultural Research (ICAR).
- Shukla, G. S., & Upadhyay, V. B. (2002). *Economic Zoology* (4th ed.). New Delhi: Rastogi Publications.

Minor 03: Ecology

Credits: 04

Minor 03T: Ecology

Credits: 03

Course objectives and expected outcome

This course introduces the basics of ecosystem structure, composition, and significance. This study provides information about factors affecting the population and community. Developed environmental monitoring skills, including conduct of experiments and data analysis. It also teaches about the significance of wildlife, the threatened category, and the conservation strategy of wildlife animals in an ecosystem.

Course Contents:

Sl. No.	Topics	Allotted Lecture
1.	Unit 1: Introduction to Ecology <ul style="list-style-type: none">• Concept of Ecology and Biosphere	4
2.	Unit 2: Population <ul style="list-style-type: none">• Concept and attributes of population• Survivorship curves, dispersal and dispersion• Geometric, exponential and logistic growth, r and k strategy of population• Population regulation-density dependent and independent factors	16
3.	Unit 3: Community <ul style="list-style-type: none">• Community characteristics: species diversity, abundance, dominance, richness,	5
4.	Unit 4: Ecosystem <ul style="list-style-type: none">• Definition and types of ecosystems with example, Food chain: Detritus and grazing food chains, Food web.• Energy flow models, Ecological pyramids and Ecological efficiencies.• Nutrient and biogeochemical cycle, Nitrogen cycle	5
5.	Unit 5: Applied Ecology <ul style="list-style-type: none">• Biodiversity- alpha, beta and gamma diversity; importance.• Impact of pollution and climate change in biodiversity.• Wildlife conservation (in-situ and ex-situ conservation)• Management strategies for tiger conservation; Wildlife Protection Act (1972)	15

Suggested Readings:

- Krebs, C. J. (2001). *Ecology: The Experimental Analysis of Distribution and Abundance* (5th ed.). San Francisco: Benjamin Cummings.
- Odum, E. P. (2008). *Fundamentals of Ecology* (5th ed., Indian ed.). New Delhi: Cengage Learning India / Brooks-Cole.
- Smith, R. L. (1974). *Ecology and Field Biology* (2nd ed.). New York: Harper & Row Publishers.
- Stiling, P. (2001). *Ecology: Theories and Applications* (4th ed.). Upper Saddle River, New Jersey: Prentice Hall.
- Cain, M. L., Bowman, W. D., & Hacker, S. D. (2011). *Ecology* (3rd ed.). Sunderland, Massachusetts: Sinauer Associates.
- Begon, M., Harper, J. L., & Townsend, C. R. (2006). *Ecology: From individuals to ecosystems* (4th ed.). Oxford: Blackwell Publishing.

Minor 03P Ecology (Practical)**Credits 01****Course contents:**

1. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Determination of pH, and Dissolved Oxygen content (Winkler's method) and free CO₂.
2. Field Report on Costal Ecosystem/ Zoo Garden/ National Park/ Wildlife Sanctuary/ Biosphere Reserve.