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

UG ZOOLOGY (MAJOR) SYLLABUS

Sem	Code	Title of the Paper	Credit	Allotted Class		Marks
				Th.	Prac.	
III	ZOOMJ03	Systematics & Taxonomy	4	3	1	75
	ZOOMJ04	Ecology	4	3	1	75
IV	ZOOMJ05	Comparative Anatomy	4	3	1	75
	ZOOMJ06	Cell Biology	4	3	1	75
	ZOOMJ07	Parasitology	4	3	1	75

UG ZOOLOGY (SEC) SYLLABUS

Sem	Code	Title of the Paper	Credit	Allotted Class		Marks
				Th.	Prac.	
III	ZOOSE03	Apiculture	3	0	3	50
IV						

UG ZOOLOGY MINOR SYLLABUS

Sem	Code	Title of the Paper	Credit	Allotted Class		Marks
				Th.	Prac.	
III	ZOOMI03	Ecology	4	3	1	75
IV	ZOOMI04	Ecology	4	3	1	75

UG ZOOLOGY IDC/MDC

Sem	Code	Title of the Paper	Credit	Marks
III	IDC-III	Artificial Intelligence in Education	3	50

UG ZOOLOGY AEC

Sem	Code	Title of the Paper	Credit	Marks
III	AEC-III	BNG/HIN-II	2	50
IV	AEC-IV	ENG-II	2	50

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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
Total		***06***	***20***	***375***

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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		
ZOOMJ03	MJ03T: Systematics & Taxonomy	Major Course	3	0	0	4	75
	MJ03P: Systematics & Taxonomy (Practical)	Major Course	0	0	1		
ZOOMJ04	MJ04T: Ecology	Major Course	3	0	0	4	75
	MJ04P: Ecology (Practical)	Major Course	0	0	1		
ZOOMI03	MI03T: Ecology	Minor Course	3	0	0	4	75
	MI03P: Ecology (Practical)	Minor Course	0	0	1		
ZOOSE03	SE03P: Apiculture	SEC	0	0	3	3	50

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** • Overview of taxonomy & systematics • Historical perspective and the significance of taxonomy in biological sciences. • Taxonomic character	5
2.	**Unit 2: The Species Concept** • 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** • Rules and conventions (ICZN). • Binomial nomenclature, typification, and the role of museums.	6
4.	**Unit 4: Morphological Techniques in Taxonomy** • Traditional morphological methods for classification. • Importance of morphological traits in different groups	4
5.	**Unit 5: Molecular Systematics** • 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** • Phylogenetic trees: types, UPGMA & Maximum Parsimony • Methods of phylogenetic analysis (cladistics, phenetics).	10

Suggested Readings:

- Mayr, E. (1942). *Systematics and the Origin of Species: From the Viewpoint of a Zoologist*. New York: Columbia University Press.
- Mayr, E., & Ashlock, P. D. (1991). *Principles of Systematic Zoology* (2nd ed.). New York: McGraw-Hill.
- Hillis, D. M., Moritz, C., & Mable, B. K. (Eds.). (1996). *Molecular Systematics* (2nd ed.). Sunderland, Massachusetts: Sinauer Associates.
- Kapoor, V. C. (2001). *Principles of Taxonomy*. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.
- Quicke, D. L. J. (1993). *Principles and Techniques of Contemporary Taxonomy*. London: Blackie Academic & Professional.

Major 03P: Systematics & Taxonomy **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** • 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** • 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** • Community characteristics: species diversity, abundance, dominance, richness • Vertical stratification, Ecotone and edge effect, Ecological succession with examples	11
4.	**Unit 4: Ecosystem** • 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** • 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:

- 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.

Major 04P Ecology **Credits 01**

Course contents:

1. Determination of population density in a natural/hypothetical community by Quadrate 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 CO_2.
3. Field Report on Costal Ecosystem/ Zoo Garden/ National Park/ Wildlife Sanctuary/ Biosphere Reserve.

SE03: Apiculture Credits: 03

SE03P: Apiculture **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** • History, classification and biology of honey bees • Social organization of bee colony • The process of production of honey	3
2.	**Unit 2: Rearing of Bees** • Artificial bee rearing (Apiary), Beehives – Newton and Langstroth • Bee pasturage • Selection of bee species for apiculture • Bee keeping equipments • Methods of extraction of honey (Indigenous and Modern) • Dissect and display- sting apparatus, hind leg	5
3.	**Unit 3: Diseases and Enemies** • Bee diseases and enemies: control and preventive measures	2
4.	**Unit 4: Bee Economy** • Products of apiculture industry and its uses (Honey, Bees Wax, Propolis)	4
5.	**Unit 5: Entrepreneurship in Apiculture** • 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:** • Construction of bee hives • Identification of bee caste, enemies (Uzi fly) • Extraction of honey • Preservation 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** • Concept of Ecology and Biosphere	4
2.	**Unit 2: Population** • 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** • Community characteristics: species diversity, abundance, dominance, richness,	5
4.	**Unit 4: Ecosystem** • 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** • 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 **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.

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Semester-IV

Course Structure

Sl. No.	Name of the Courses	No. of Papers	Credits	Full Marks
1.	Major	03	12 (4x3)	225 (75x3)
2.	Minor	01	04	75
3.	AEC English	01	02	50
4.	Professional Course	01	02	50
Total		***06***	***20***	***400***

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Curriculum for Undergraduate in Zoology

[NEP 2020]

Semester-IV

Paper Code	Name of the Subject	Nature	Teaching Scheme in hour per week			Credit	Marks
			L	T	P		
ZOOMJ05	MJ05T: Comparative Anatomy	Major Course	3	0	0	4	75
	MJ05P: Comparative Anatomy (Practical)	Major Course	0	0	1		
ZOOMJ06	MJ06T: Cell Biology	Major Course	3	0	0	4	75
	MJ06P: Cell Biology (Practical)	Major Course	0	0	1		
ZOOMJ07	MJ07T: Parasitology	Major Course	3	0	0	4	75
	MJ07P: Parasitology (Practical)	Major Course	0	0	1		
ZOOMI04	MI04T: Ecology	Minor Course	3	0	0	4	75
	MI04P: Ecology (Practical)	Minor Course	0	0	1		

L= Lecture, T=Tutorial, P=Practical

Major 05: Comparative Anatomy Credits: 04

Major 05T: Comparative Anatomy **Credits: 03**

Course objectives and expected outcome

The students will be able to understand the basic structure, organization of anatomical systems like digestive systems, respiratory system, urinogenital system, central nervous system, olfactory system etc., and their modification in the major transitions in vertebrate's evolution

Course Contents:

Sl. No.	Topics	Allotted Lecture
1.	**Unit 1: Integumentary System** • Structure, function and derivatives of integument in tetrapods	5
2.	**Unit 2: Skeletal System** • Overview of axial and appendicular skeleton, Jaw suspension; Visceral arches of amniotes (reptiles, birds and mammals)	5
3.	**Unit 3: Digestive System** • Stomach in mammals. • Dentition in mammals.	6
4.	**Unit 4: Respiratory System** • Respiratory organs of fish, amphibian, birds and mammals.	6
5.	**Unit 5: Circulatory System** • General plan of circulation • Comparative account of heart and aortic arches of amniotes.	7
6.	**Unit 6: Urinogenital System** • Evolution of kidney and urinogenital ducts • Types of mammalian uteri.	7
7.	**Unit 7: Nervous System** • Comparative account of brain. • Cranial nerves in mammals	6
8.	**Unit 8: Sense Organs** • Brief account of olfactory and auditory receptors in vertebrate.	6

Suggested Readings:

- Kardong, K. V. (2006). *Vertebrates: Comparative Anatomy, Function, Evolution* (4th ed.). Boston: McGraw-Hill Higher Education.
- Kent, G. C., & Carr, R. K. (2001). *Comparative Anatomy of the Vertebrates* (9th ed.). New York: McGraw-Hill.
- Hildebrand, M. (1988). *Analysis of Vertebrate Structure* (3rd ed.). New York: John Wiley & Sons.
- Saxena, R. K., & Saxena, S. C. (2008). *Comparative Anatomy of Vertebrates*. New Delhi: Viva Books Pvt. Ltd.

Major 05P: Comparative Anatomy (Practical) **Credits: 01**

(1) Study of placoid, cycloid and ctenoid scales through permanent slides/photographs.

(2) Study of disarticulated skeleton of Toad, Pigeon and Guineapig

(3) Demonstration of Carapace and plastron of turtle.

(4) Identification of mammalian skulls: One herbivorous (Guineapig) and one carnivorous (Dog) animal

(5) Dissection of Tilapia: brain, pituitary, urinogenital system.

Major 06: Cell Biology Credits: 04

Major 06T: Cell Biology **Credits: 03**

Course objectives and expected outcome

Students will acquire comprehensive knowledge of membrane structure and composition, protein transport and trafficking, the cytoskeleton, cell movement, and the extracellular matrix. They will gain a thorough understanding of the mechanisms of cell division and its regulation through different checkpoints. The cell cycle, apoptosis, signal transduction, and cancer biology will be integral components of the course.

Course Contents:

Sl. No.	Topics	Allotted Lecture
1.	**Unit 1: Overview of Cells** Basic structure of Prokaryotic and Eukaryotic cells and organelles, Viruses, Viroid, Prion and Mycoplasma.	4
2.	**Unit 2: Plasma Membrane** Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes, Ultra structure and composition of Plasma membrane: Fluid mosaic model, Transport across membrane: Active and Passive transport, Facilitated transport, Cell junctions: Tight junctions, Gap junctions, Desmosomes.	8
3.	**Unit 3: Cytoplasmic Organelles I** Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes, Protein sorting and mechanisms of vesicular transport	5
4.	**Unit 4: Cytoplasmic Organelles II** Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis, Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis, Peroxisomes: Structure and Functions, Centrosome: Structure and Functions	5

5.	**Unit 5: Cytoskeleton** Type, structure and functions of cytoskeleton, Accessory proteins of microfilament &microtubule, A brief idea about molecular motors.	5
6.	**Unit 6: Nucleus** Structure of Nucleus: Nuclear envelope, nuclear pore complex, Nucleolus, Chromatin: Euchromatin and Hetrochromatin and packaging (nucleosome).	5
7.	**Unit 7: Cell cycle and its Regulation** Cell cycle and its regulation, Cancer (Concept of oncogenes and tumor suppressor genes with special reference to p53, Retinoblastoma and Ras and APC). Apoptosis. Mitosis and Meiosis: Basic process and their significance.	7
8.	**Unit 8: Cell Signaling** Ligands and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial chemotaxis and quorum sensing.	5

Suggested Readings:

- Cassimeris, L., Lingappa, V. R., & Plopper, G. (2011). *Lewin's Cells* (2nd ed.). Sudbury, Massachusetts: Jones & Bartlett Learning.
- Weinberg, R. A. (2014). *The Biology of Cancer* (2nd ed.). New York: Garland Science.
- Cooper, G. M., & Hausman, R. E. (2009). *The Cell: A Molecular Approach* (5th ed.). Washington, D.C.: ASM Press; Sunderland, Massachusetts: Sinauer Associates.
- Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2008). *Molecular Biology of the Cell* (5th ed.). New York: Garland Science.

Major 06P: Cell Biology **Credits: 01**

Course Contents:

1. Cytological preparation of meiotic stages from short horned grasshopper testis.
2. Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.
3. Mitochondria identification through vital staining

Major 07: Parasitology Credits: 04

Major 07T: Parasitology **Credits: 03**

Course objectives and expected outcome

The course will provide an understanding of the diversity and biology of parasites, besides the epidemiological aspects of different parasitic diseases will be explored and students will be able to gain knowledge regarding the mode of transmission of parasitic diseases and its preventive measures.

Course Contents:

Sl. No.	Topics	Allotted Lecture
1.	**Unit 1: Introduction to Parasitology** The basic concept of Parasitism. Types of parasites and hosts. Carrier and Vectors. Host parasitic interactions	6
2.	**Unit 2: Parasitic Protists** Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Plasmodium vivax, Leishmania donovani*	7
3.	**Unit 3: Parasitic Platyhelminthes** Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Diphyllobothrium latum, Taenia solium*	6
4.	**Unit 4: Parasitic Nematodes** Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Ascaris lumbricoides, Brugia malayi*	8
5.	**Unit 5: Parasitic Arthropods** Biology, importance and control of ticks (Soft tick *Ornithodoros*, Hard tick *Ixodes*), mites (*Sarcoptes*), Lice (*Pediculus*), Flea (*Xenopsylla*) and Bug (*Cimex*)	10
6.	**Unit 6: Zoonotic disease (with special reference to)** *Wuchereria bancrofti, Schistosoma haematobium, Giardia intestinalis*	8

Suggested Readings:

- Arora, D. R., & Arora, B. B. (2001). *Medical Parasitology* (2nd ed.). New Delhi: CBS Publishers & Distributors.
- Noble, E. R., & Noble, G. A. (1982). *Parasitology: The Biology of Animal Parasites* (5th ed.). Philadelphia: Lea & Febiger.
- Ahmed, N., Dawson, M., Smith, C., & Wood, E. (2007). *Biology of Disease*. New York: Taylor & Francis Group.

- Parija, S. C. (2004). *Textbook of Medical Parasitology: Protozoology and Helminthology (Text and Colour Atlas)* (2nd ed.). Chennai: All India Publishers & Distributors.
- Ichhpujani, R. L., & Bhatia, R. (2007). *Medical Parasitology* (3rd ed.). New Delhi: Jaypee Brothers Medical Publishers (P) Ltd.
- Murray, D. D., & Dailey, M. D. (1995). *Meyer, Olsen and Schmidt's Essentials of Parasitology*. Dubuque, Iowa: W. C. Brown Publishers.
- Chatterjee, K. D. (2009). *Parasitology: Protozoology and Helminthology* (13th ed.). New Delhi: CBS Publishers & Distributors (P) Ltd.

Major 07P: Parasitology **Credits: 01**

Course Contents:

1. Study of life stages of *Giardia intestinalis, Leishmania donovani*, *Plasmodium* sp. through permanent slides / photographic plate.
2. Identification: *Pediculous* sp*., Xenopsylla* sp*., Cimex* sp*., Taenia* sp.
3. Study of nematode/cestode parasites from the intestines of Poultry bird/Cockroach (Intestine can be procured from poultry/market as a by-product.

Minor 04: Ecology Credits: 04

Minor 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** • Concept of Ecology and Biosphere	4
2.	**Unit 2: Population** • 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** • Community characteristics: species diversity, abundance, dominance, richness,	5
4.	**Unit 4: Ecosystem** • 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** • 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 **Credits 01**

Course contents:

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

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