

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**



**Name of the Faculty: Science & Technology**

**Syllabus: Zoology**

**Name of the Course: Entrance Examination – Paper II  
(PET- 9)**

**(Syllabus to be implemented from June 2024)**

**Punyshlok Ahilyadevi Holkar Solapur University, Solapur**

**Zoology PET-9 Syllabus**

**UNIT-I: Classification of animal kingdom:-Chordates and non-chordates**

**A. Non-chordata:-**

- i. Concept of species and speciation.
- ii. Evolution of symmetry, segmentation and coelom in metazoa.
- iii. **Protozoa:**-Locomotion and reproduction in protozoa.
- iv. **Porifera:**-canal system and skeleton.
- v. **Coelelerata:**-Polymorphisn in coelelerata, coral reefs and there significances.
- vi. **Platyhelminthes and aschelminthes:**-Life cycle of *Fasciola hepatica*, *Tenia solium*, *Ascaries*, Parasitic adaptation, Pathology and control of helminthes- infecting man.
- vii. **Annelida:**-Segmentation in Annelida, Economic importance of Annelids.
- viii. **Arthropoda:**-Crustation larvae, mouth parts in insects (Cockroach, Honey bee, Butterfly, mosquito), Metamorphosis in insect, social life in termites and honey bees.
- ix. **Mollusca:**-Torsion and detorsion in gastropoda, respiration in Mollusca.
- x. **Echinodermata:**-Water vascular system, Echinoderm larva and their polygenic significance.

**B. Chordates: -**

- i. **Protochordata:**-Structural organization and affinities of Balanoglossus. Retrogressive metamorphosis in eurochordata, feeding mechanism in amphioxus.
- ii. **Pisces:**-Migration in fishes. Respiratory and mechanism of respiration in fishes. Receptor and effector organs in fishes. Morphometric characters in fishes.
- iii. **Amphibian:**-Parental care in amphibian, Neoteny, metamorphosis in frog.
- iv. **Reptilian:**-Significance of temporal vacuities in classification reptilians. Non-poisonous and poisonous snakes in India.
- v. **Aves:**-Bird migration, flight adaptation in birds.
- vi. **Mammals:**-Dentition in mammals. General characters of prtothenia, metathenia and Euthenia

**Unit – II Animal Physiology**

- i. **Blood and circulation:** Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis.
- ii. **Cardiovascular System:** Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure.
- iii. **Respiratory system:** Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.
- iv. **Nervous system:** Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture.
- v. **Sense organs** – Vision, hearing and tactile response.
- vi. **Excretory system:** Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.

- vii. **Thermoregulation:** Comfort zone, body temperature—physical, chemical, neural regulation, acclimatization.
- viii. **Stress and adaptation.**
- ix. **Digestive system:** Digestion, absorption, energy balance, BMR.
- x. **Endocrinology and reproduction:** Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, gametogenesis, ovulation, neuroendocrine regulation.

### Unit-3 Cell biology and principles of Genetics

#### A. Cell Biology

- i. **Overview of Cells Prokaryotic and Eukaryotic cells, Virus**
- ii. **Plasma Membrane:** Singer & Nicholson's model of plasma membrane. An overview of active transport and passive transport, across membranes: Uniport, Antiport, Symport
- iii. **Endomembrane System:** Structure and Functions: Endoplasmic Reticulum, Golgi apparatus, Lysosome.
- iv. **Mitochondria:** Ultrastructure, Semi-autonomous nature, Endosymbiotic hypothesis functions.
- v. **Cytoskeleton:** Structure and Functions: Microtubules, Microfilaments, Intermediate filaments
- vi. **Nucleus:** Structure and functions of Nucleus, Nuclear envelope, Nuclear pore complex, Nucleolus, Chromatin: Euchromatin, Heterochromatin and nucleosome
- vii. **Chromosome:** Types of chromosomes, Acrocentric chromosome, metacentric chromosome, telocentric chromosome, acentric chromosome.
- viii. **Cell Division:** Cell cycle, Mitosis and Meiosis

#### B. Principles of Genetics

- i. **Mendelian Genetics and its Extension:**  
Principles of inheritance-Laws of Mendelian Inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles; Gene Interactions: Supplementary, Complementary & Inhibitory interactions; Examples of Sex-linked, sex-influenced and sex-limited characters inheritance.
- ii. **Linkage, Crossing Over and Chromosomal Mapping:**  
Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity; Somatic cell hybridization.
- iii. **Mutations:** Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations: CLB method.
- iv. **Sex Determination:** Chromosomal mechanisms of sex determination in Drosophila and Human; Human Genetic Disorders: Mechanism, symptoms, treatment: Down's Syndrome, Klinefelter's Syndrome and Turner's Syndrome.
- v. **Extra-chromosomal Inheritance:** Extra-chromosomal inheritance with examples
- vi. **Polygenic Inheritance:** Polygenic inheritance with suitable examples; simple numerical.

- vii. **Recombination in Bacteria and Viruses:** Conjugation, Transformation, Transduction with examples; Complementation test in Bacteriophage.
- viii. **Transposable Genetic Elements:** Transposons in bacteria

## Unit- 4 Applied Zoology

- i. **Introduction to Aquaculture:** Fish Culture, Breeding Pond, Fish Seed, Hatching Pond. Transport of fish fry to rearing ponds. Harvesting, preservation of fish. By products of fishing industry and common fish diseases; Prawn culture: Culture of freshwater prawn
- ii. **Fisheries:** Inland Fisheries; Marine Fisheries Fishing crafts and Gears; Depletion of fisheries resources; Application of remote sensing and GIS in fisheries; Fisheries law and regulations. Application of biostatistics in Fishery: morphometric analysis of length, weight to determine mean, mode, variance and standard deviation.
- iii. **Apiculture:** Species of honeybees in India. Life history of Apis. Methods of Bee keeping. Bee products and their uses. Natural enemies and their control. Medicinal value of honey; Importance of bee colonies in crop pollination.
- iv. **Lac culture:** Lac insect and its life cycle, Cultivation of lac insect, host plants, processing and uses of lac.
- v. **Sericulture:** Types of silk; Silkworms and their host plants; Mulberry silkworm culture; Life history of silkworm; Natural enemies and their control
- vi. **Dairy Management:** Introduction to common dairy animals. Techniques of dairy management. Milk and milk products. Cattle Diseases.
- vii. **Poultry Management:** Types of breeds. Rearing method. Diseases and control measures. Housing and Equipment, Deep litter System, Laying cages, Methods of brooding and Rearing, Feed formulations for chicks, Diseases of fowl. Nutritive value of egg and meat. Incubation and hatching of eggs.
- viii. **Recent advances applied zoology:** Zebrafish as a model organism in research, transgenic animals (Salmon, chicken, goat, pigs) & its significance.

## Unit- 5 Ecology, Ethology

### A) ECOLOGICAL PRINCIPLES:

- 1) **Habitat, Niche & Population Ecology:** Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement; Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection); concept of metapopulation
- 2) **Species and Community Ecology:** Types of interactions, inter-specific competition, herbivory, carnivory, symbiosis; Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotone.
- 3) **Ecosystem & Ecological Succession:** Types; mechanisms; changes involved in succession; concept of climax; Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine).
- 4) **Biogeography & Applied Ecology:** Major terrestrial biomes; theory of island biogeography; biogeographical zones of India; Environmental pollution; global environmental change; biodiversity-status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

## Unit : 6 Evolution And Behaviour:

- 1) **Emergence of Evolutionary Theories:** Lamarck; Darwin—concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; spontaneity of mutations; evolutionary synthesis.
- 2) **Origin of cells, Paleontology and evolutionary history:** History of ideas, Abiotic synthesis of organic molecules, polymers & first cell; concept of Oparin and Haldane; experiment of Miller; evolution of prokaryotes; origin of eukaryotic cells; evolution of unicellular eukaryotes The evolutionary time scale; eras, periods and epoch; major events in the evolutionary time scale; major groups of animals; stages in primate evolution including *Homo*.
- 3) **Molecular Evolution & The Mechanism(s):** Concepts of neutral evolution, molecular divergence and molecular clocks; molecular tools in phylogeny, classification and identification; protein and nucleotide sequence analysis; origin of new genes and proteins; gene duplication and divergence; Population genetics: populations, gene pool, gene frequency; Hardy-Weinberg law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift; adaptive radiation and modifications; Reproductive isolation and modes of speciation; co-evolution.
- 4) **Brain, Behavior and Evolution:** Approaches and methods in study of behavior; historical contributions in behavior; proximate and ultimate causation; altruism, group & kin selection, reciprocal altruism; Innate & Learned behaviors; parental care; migration, orientation and navigation; Associative learning, classical and operant conditioning, Habituation, Imprinting, Foraging & dance language in honey bee and its advantages; mating systems: Intra-sexual selection (male rivalry), Intersexual selection (female choice); Sociobiology; biological clocks & chronobiology.

## Unit- 7 Recent Techniques In Biology

### A. Molecular Biology and Recombinant DNA methods:

- i. Isolation and purification of RNA , DNA (genomic and plasmid) and proteins,different separation methods. Analysis of RNA, DNA and proteins by one and two dimensional gelelectrophoresis, Isoelectric focusing gels.
- ii. Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems. Expression of recombinant proteins using bacterial, animal and plant vectors.
- iii. Isolation of specific nucleic acid sequences. Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors.
- iv. In vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms.
- v. Protein sequencing methods, detection of post translation modification of proteins.
- vi. DNA sequencing methods, strategies for genome sequencing.
- vii. Methods for analysis of gene expression at RNA and protein level, large scale expression, such as micro array based techniques.
- viii. Isolation, separation and analysis of carbohydrate and lipid molecules RFLP, RAPD and AFLP techniques.

## **B. Histochemical And Immunotechniques**

Antibody generation, Detection of molecules using ELISA, RIA, western blot, immunoprecipitation, fluocytometry and immunofluorescence microscopy, detection of molecules in living cells, in situ localization by techniques such as FISH and GISH.

## **C Biophysical Method:**

- i. Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy Molecular structure determination using X-ray diffraction and NMR, Molecular analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.
- ii. **Electrophysiological methods:** Single neuron recording, patch-clamp recording, ECG, Brain activity recording, lesion and stimulation of brain, pharmacological testing, PET, MRI, fMRI, CAT .
- iii. **Radiolabeling techniques:** Detection and measurement of different types of radioisotopes normally used in biology, incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines.

## **D. Microscopic techniques:**

Visualization of cells and sub cellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze- fracture methods for EM, image processing methods in microscopy.

# **Unit- 8 Computational Biology**

**A. Measures of Central Tendency and measures of dispersion:** Data representation and plotting, Meaning and Definition of Arithmetic mean, median and mode.

**B. Absolute and relative measures of dispersion:** Range and its coefficient, Mean deviation and its coefficient, Quartile deviation and its coefficient. Standard Deviation and Coefficient of Variation

**C. Measures of Central Tendency and measures of dispersion:** Data representation and plotting, Meaning and Definition of Arithmetic mean, median and mode.

**D. Correlation and Regression:** Meaning and its type, Scatter diagram, Karl Pearson coefficient of correlation, Spearman's Rank correlation coefficient ,Linear Regression

**E. Discrete and Continuous Distribution:** Binomial distribution, Poisson distribution, Poisson approximation to Binomial distribution, Joint distribution of two variables, Normal and Standard normal distribution.

**F. Tests of Hypotheses:** Formulation of Hypothesis Simple and Composite, Type I and Type II errors, Power of a test, Significance of a test, P-value, Testing Normal, Chi-square, t test and

F-test, Z test Nonparametric test.

## Unit-9 Developmental Biology

- A) Basic concepts of development :** Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development
- B) Gametogenesis, fertilization and early development:** Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac, zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals;
- C) Morphogenesis and organogenesis in animals:** Cell aggregation and differentiation in and pattern formation in *Drosophila*, amphibia and chick; organogenesis –limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development- larval formation, metamorphosis; environmental regulation of normal development; sex determination.

## Unit-10 Molecular Biology

1. Organization of DNA; Evidences for DNA as a genetic material- Transformation, Transduction and Conjugation.
2. Replication of DNA; DNA damage and repair mechanism.
3. Protein Synthesis a) Transcription - Process of transcription in prokaryotes, RNA polymerases, Post transcriptional modifications in RNA.
4. Translation –Activation of amino acids, Binding or transfer of amino acid to t RNA. Initiation, Elongation, Termination
5. Genetic Code -Properties of Genetic Code, Codon assignments; Initiation codon; Termination codon; Codon and anticodon pairing; Wobble hypothesis.
6. Regulation of gene expression –With reference to Lac- operon concept

### List of Reference Books

1. Invertebrate Zoology- (W.B. Saunders Co.) – Barnes R.D.
2. Treatise in Zoology Sedgwick Vol III
3. Modern Text Book of Zoology, Invertebrates – R.L.Kotpal.
4. Life of Invertebrates – S.N. Prasad, Vikas publishing House, New Delhi.

5. Practical Zoology, Invertebrates- S.S. Lal.
6. Bioinformatics- Murti, Himalaya Publications.
7. Introduction to Bioinformatics Attwood Pearson Education Delhi
8. Parasitology-Chandler, Allied Agency, Kolkata.
9. Essentials of Parasitology – Gerald D. Smidth, South Delh.
10. Introduction to Biostatistics Pranab Kumar Banerjee S. Chand and Company. New
11. Evolution : Mark Ridley Blackwell Publishing In India marketed by John Wiley and Sons.
12. Cell and Molecular Biology, 8th Edition, De. Robertis EDP and De
13. Robertis Jr. EMF, Lippincott Williams and Wilkins, Philadelphia, ’
14. Cell Biology, C.B. Powar, Himalaya Publication House.
15. Cell and Molecular Biology, E.J. Dupraw, Academic Press, NewYork.
16. Cell Structure and Function – A. G. Loewy, P. Siekevitz, J. R. Meninger
17. & J. A. N. Gallant, Saunder College, Philadelphia.
18. Molecular Biolology of the Cell – 3rd Edition, Bruce Alberts, Dennis Bray,
19. Julian Lewis, Martin Raff, Keith Roberts & James D. Watson, Garlan
20. Publishing, New York.
21. Elements of Biotechnology – P. K. Gupta, Rastogi Publications.
22. Gene V & VI, 1994, Lewin B., Oxford University Press, Oxford.
23. Prawn and Prawn Fishery of India – Kurian.
24. Fish Culture – K. H. Alikuhni.
25. Fish Culture – Lagler.
26. Fishes of India. – Zingran
27. Manual of sericulture – Krishnaswami et. al.
- 28.** Introduction to sericulture – Ganga and Shetty.
29. Statistical Methods (Volume 1 and 2) (1st Ed.), N. G. Das, Tata McGraw-Hill, 2009
30. Fundamentals of Biostatistics (6th Ed.), Bernard Rosner, Thomson Brooks/Cole,
31. Primer of Biostatistics. McGraw-Hill Medical, 2011. ISBN: 9780071781503.  
[Preview with [Google Books](#)]
32. Gupta and Kapoor, "Fundamentals of Applied Statistics", Sultan Chand and sons, 4th Edition, New Delhi, 2019.
33. Hooda, "Statistics for Business and Economics", Macmillan, 3rd Edition, India, 2003.
34. John.E.Freunds, "Mathematical statistics with applications", Pearson Education, 8th Editi on, New Delhi, 2013.
35. Levin and Rubin, "Statistics for Management", Pearson Education India, 7th Edition, New Delhi, 2013.
36. An Introduction to Embryology 2003, Balinsky B.L., Saunders College, Philadelphia.
37. Developmental Biology; Patterns/Principles/Problems, 1982, Saunders J. W. Collier MacMillan, Publishers, London.
38. Developmental Biology, 2004 , 3rd Edition, Gilbert S.F. Saunder Associates Inc. U.S.A.
39. Developmental Biology, 1992 3rd edition, Browder L.W. Erickson C.A. & Williams, R.J. Saunders College, Publications, London.
40. A Text Book of Embryology, Dr. Puranik P. G. , S. Chand & Co.
41. Developmental Biology, 1984, Browder L.W. , Saunders College Publicaions, U.S.A.
42. Development of Chick embryo, 1972, Lillie.



43. Outlines of comparative anatomy, Romer & Parsons, Central Book Depot, The Vertebrate Body (Saunders).
44. Biology of Vertebrates Walter & Sayles; (McMillan).
45. Modern Textbook of Zoology, R. L. Kotpal, Rastogi Publications, Meerut.
46. The Life of Vertebrates, 3rd Edition, 1993, J. Z. Young E. L. B.S. Oxford.
47. Chordate Zoology – E.L. Jordan, S. Chand & Co., New Delhi.
48. The Phylum Chordata – 1987, H.H. Newman, Distributor Satish Book Enterprise, Agra.
49. General and Comparative Physiology – Hoar (Prentice Hall).
50. Animal Physiology – Nelson (Cambridge).
51. Comparative Animal Physiology – Prosser (Satish Book Enterprise).
52. Endocrinology – Hadley Pearson Education Delhi
53. General Endocrinology – Bagnara & Turner (W.B. Saunders)
54. Ecology – Odum (Amerind) 7. Limnology – Welch (McGraw Hill)
55. Introduction to Environmental Science – Y Anjaneyulu (B.S. Publications)
56. Animal Physiology – Adaptation and Environmental – Schiemdt Nielson (Cambridge)
57. Physiology : A regulatory systems approach – Strand F.L. (McMillon Publications Co.).
58. Environmental and Metabolic Animal Physiology – Prosser C.L. (Wiley – Liss Inc.)
59. Environment Physiology- Willmet P.G., Stone & Johnson (Blackwell Science, Oxford).
60. Physiological Animal Ecology – Loan G.N. (Longman Harlog, UK)