

UNIVERSITY OF KALYANI

DIRSETORATE OF OPEN AND DISTANCE LEARNING **(DODL)**

ZOOLOGY – SEMESTER- I SYLLABUS (CBCS)

(With effect from the session 2021–2022)

ZCORT-101: Non-Chordate Biology and Insect Organization (6 credits, 20 units)

Group-A: Non-Chordate Biology

1. Origin & Evolution of Metazoans.
2. Cell organelles in Protozoa: Golgi, Mitochondria, Kinetoplast, Pellicle and Cuticle.
3. Cell association and cellular differentiation in Protozoa.
4. Osmoregulation in Protozoa and Nematodes.
5. Sense organs and their importance - Chemoreception, photoreception and mechanoreception; sensory organelles and reaction for stimuli in protozoa.
6. Organs and process of reproduction in major invertebrate groups.
7. Structural organization of respiratory organs in major invertebrate groups; factors affecting respiration.
8. Photogenic organs in insects: structure, mechanism and significance of light production.
9. a) Trochophore larva: Structure and evolutionary significance.
b) Evolutionary significance of minor invertebrate phyla.
10. Insect flight: types; structure concerned; functional mechanism; evolution of flight patterns in different insect groups.

Group-B: Insect Organization

1. Modern classification of insects.
2. General organization, segmentation, division of body:
 - i) Head and mouth-parts in general
 - ii) Thorax and thoracic appendages. Modification of legs and wings.
 - iii) Abdomen and abdominal appendages.
3. Integument: Basic structure and functions; modification in different insect groups.
4. Digestive organs: Structure and functions; Peritrophic membrane, Filter chamber.
5. Structure and functions of the central nervous system in insects.
6. Insect visual organs, their structure and functional mechanisms.
7. Insect blood: composition, functions, morphology of circulatory system.
8. Structure and function of sound producing organs in insects; types of insect sound; significance of sound production.
9. Exocrine glands: Lac gland, Wax gland, Silk gland, Labial gland.
10. Metamorphosis in insects: hormonal regulation; factors affecting metamorphosis; diapause.

ZCORT-102: Parasitology, Ecology, Environment and Wildlife Biology (6 credits, 20 units)

Group-A: Parasitology

1. Concept of parasitism, symbiosis commensalism and mutualism.
2. Host-parasite interaction: immunopathological consequences in parasitic infections.
3. Classification of Protozoa and Helminths.
4. *Entamoeba* and Blood Flukes in Humans.
5. Microspora: Structure and life history of *Nosema bombycis* -impact on sericulture.
6. Mode of transmission of *Plasmodium*, *Trypanosoma* and Piroplasm.
7. Zoonosis with particular reference to *Toxoplasma* and *Schistosoma*.
8. Life cycle, biology, pathogenesis, epidemiology and control of medically important helminths – *Diphyllobothrium latum*, *Paragonimus westermani*,
9. Life cycle, biology, pathogenesis, epidemiology and control of medically important helminths – *Trichinella spiralis* and *Wuchereria bancrofti*.

10. Salient features of plant parasitic nematodes and life cycle patterns of

i) *Meloidogyne hapla*, ii) *Anguina tritici*.

Group-B : Ecology, Environment and Wildlife Biology

1. The Ecosystem: Gaia hypothesis, cybernetic nature and stability of the ecosystem, ecosystem management and optimization. Macroecology: concept and consequences. Principles of Thermodynamics, energy flow and ecological energetics.
2. Niche theory: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement. (Lotka-Volterra model, Isoclines, Niche prediction).
3. Community: Structure and Gradient analysis, Structure of biotic community. Community patterns: diversity and stability. Community boundary: Ecotone and edge types, Edge effect and edge species, Leibig's Law of the minimum.
4. Population attributes: Growth forms and mathematics of growth, Life Table - (Cohort and Static); survivorship curves, generation time, net reproductive rate, gross reproductive rate, vital index. Life history strategies: Evolution of life history traits, strategies related to longevity; clutch size; life history optimization.
5. Metapopulation: Concept, models, structure and dynamics
6. Major terrestrial biomes: Theory of island biogeography, Biogeographical zones of India
7. Concept of Environment: Structure, radiation balance, UN movements on environment.
8. Theory and analysis of conservation: Stochastic perturbations, population viability analysis, recovery strategy for threatened species: Different approaches for conservation – in-situ and ex-situ, In-situ conservation- problems and prospects; Sanctuaries, National parks, Community Reserves and Conservation Reserves; Biosphere Reserve, EIA and EIS.
9. Conservation biology of important wild animals: Conservation status, habit & habitat, threats and conservation management of the following animals: Olive Ridley Turtle / Greater one-horned *Rhinoceros*/ Ganges river dolphin.

10. Basic Concept of Wildlife Biology: Wildlife wealth of India; Threatened wildlife and IUCN status - Concept of Extinct, Critically Endangered, Endangered, Vulnerable and rare species; concept of corridor.

ZCORT 103: Developmental Biology and Cytogenetics (6 credits, 20 units)

Group-A: Developmental Biology

1. Overview of early embryonic development and morphogenesis.
2. Potency, induction, germ cell migration, competence, commitment:
3. specification, determination and differentiation, morphogenetic gradient and fate map.
4. Axis specification in *Drosophila*: role of maternal effect genes, patterning of early embryo by zygotic genes, gap genes, pair- rule genes, segment polarity genes, homeotic selector genes- bithorax and antenapedia complex.
5. Axis specification in vertebrates: Early patterning in vertebrates - Symmetry breaking, Nieuwkoop center. Wnt and cadherin signaling, TGF β signaling in early developmental process, asymmetric gene expression.
6. General concepts of organogenesis: Development and patterning of vertebrate limb, homeobox genes in patterning, signaling in patterning of the limb;
7. Insect imaginal discs-organizing center in patterning of the leg and wing, the homeotic selector genes for segmental identity; insect compound eye.
8. Postembryonic development: growth, cell proliferation, growth hormones; aging- genes involved in alteration in timing of senescence
9. Regeneration- Epimorphic regeneration of reptile (salamander) limb; Morphogenesis regeneration in Hydra.
10. Programmed cell death: apoptosis, autophagy and necrosis.

Group B: Cytogenetics

1. Organization and Structure of Genomes: Organization and nature of eukaryotic nuclear DNA, Size and complexity of eukaryotic genome
2. Transposable elements, retrotransposons, SINE, LINE, Alu and other repeat elements,
3. Pseudogenes, segmental duplications; Super coiling of DNA. Giant chromosomes:
4. Classes of DNA, Virus and Bacterial genomes, Mitochondrial genome.
5. Phases of Cell cycle, Check Points, Regulation of cell cycle; MPF, cyclins and cyclin-dependent kinases.
6. Cancer-Types and Stages, Carcinogens, Tumor suppressor genes and Proto-oncogenes induction to oncogenes. Concepts of Apoptosis
7. Regulators of Apoptosis, Caspases, Pathways of apoptosis; Cell Senescence, Necrosis.
8. DNA Replication and Recombination: Topology, Variations and Nature of Replication; Replicon, Replicator, Fidelity and Processivity of replication; "Hayflick limit" and Telomerase activity; Regulation of Replication
9. DNA damage response; Drugs and Inhibitors targeting replication-antibacterial, antiviral and anticancer; and DNA Repair
10. Extrachromosomal Replicons; Homologous Recombination

ZCORT 104: Animal Physiology, Biochemistry and Metabolic Processes (6 credits, 20 units)

Group-A: Animal Physiology

1. Respiratory function of blood: Respiratory pigments –types, distribution and brief chemistry. Structure and function of haemoglobin- i) in adult and ii) during embryonic life.
2. Transport of oxygen and carbon dioxide in blood and body fluids, Regulation of respiration.

3. Physiology of excretion: Formation of urine: Physiology of ultrafiltration, Reabsorption tubular secretion Counter current theory of urine concentration, Regulation of urine formation, Renal regulation of acid- base balance.
4. Synaptic transmission; types of synapses, Pre- and postsynaptic structure and function, Steps in Synaptic Transmission.
5. Chemistry and modes of neurotransmitter release, proteins in synaptic transmission: SNARE hypothesis: synapsins, synaptobrevin, synaptotagmin, SNAP and NSF, synaptic plasticity, toxins in synaptic transmission
6. Cytoskeleton, Extracellular matrix, gap junctions, integrins, cell adhesion molecules and their functions
7. Intracellular protein trafficking for secretory and non-secretory cells: Protein synthesis, Protein sorting and targeting to organelles; signal sequences, vesicle transport, packaging, storage and release, Targeting of proteins to lysosomes for degradation; Receptor mediated endocytosis.
8. Physiology of muscle contraction and proteins associated with muscle contraction: Physiology of muscle contraction, Chemical nature of contractile elements, actin nucleation, actin treadmilling, myosin types, structure, Role of structural and regulatory proteins in muscular contraction (profilin, cofilin, thymosin, troponin, tropomyosin, Arp 2/3 complex), ATP and signal molecules in muscular contraction, neuromuscular junction and its functioning.

Group-B : Biochemistry and Metabolic Processes

1. Carbohydrate metabolism: Carbohydrates of physiological significance. Glycolysis, Gluconeogenesis.
2. Hexose monophosphate Shunt, Glycogenesis and glycogenolysis, Control and regulation of carbohydrate metabolism
3. Amino acid metabolism: Amino acid classification, Urea cycle.
4. Proteins: Protein folding and protein stability.
5. Bioenergetics (anaerobic and aerobic respiration, oxidative and substrate level phosphorylation) basic concept of ETC and ATP synthesis, uncouplers. Spontaneous reaction (concept of ΔG). Thermodynamic principles and steady-state conditions of living organism.

6. Biosynthesis of cholesterol, control of cholesterol biosynthesis.
7. Lipoproteins and types of cholesterol transport.
8. Enzymes: Kinetic analysis of enzyme-catalyzed reaction, Michaelis-Menten Equation, Lineweaver-Burk's plot, Bi-substrate Reactions.
9. Enzyme inhibitions, Regulation of enzyme activity, Allosteric control of enzyme activity
10. Chemistry of free radicals and antioxidants.
11. Vitamins Role of vitamins as coenzymes.
12. Minerals: Role of minerals in human physiology

ZAECCT-101: Basic Principles of methods used in Animal Biology (2 credits, 06 units)

1. Microscopy: Basic concepts of light and electron microscopy (magnification, resolution, limit of resolution, chromatic aberrations).
2. Common spectroscopic methods, Electromagnetic radiation, Principle of spectroscopy.
3. Histochemical and immunological techniques: Tissue processing, microtomy, fixatives (types and function), staining.
4. Antibody generation, antigen-antibody interaction and immunohistochemistry.
5. Radio labelling techniques: Properties of different types of radioisotopes normally used in biology, their detection and measurement; incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines.
6. Methods in field biology: Methods of estimating population density of animals, ranging patterns through direct, indirect and remote observations, sampling methods in the study of behaviour, habitat characterization-ground and remote sensing methods.