

## 18. SYLLABUS FOR COMPETITIVE EXAMINATION FOR THE POST OF TEACHING ASSOCIATE IN ZOOLOGY

### UNIT- I: Taxonomy:

- (a) Principles, rules and basis of Taxonomy and classification.
- (b) Binomial system of nomenclature.
- (c) General survey of animal kingdom, classification up to order and inter-relationship of the various phyla.

### UNIT- II: Diversity of Life Forms:

Structure and functions of the invertebrates (Protozoa to Echinodermata) and their economic importance.

- (a) Levels of structural organizations- Unicellular, colonial and multicellular forms, Coelom, segmentation and metamerism.
- (b) Locomotory organs and their mechanisms.
- (c) Food, feeding and digestion.
- (d) Respiration.
- (e) Excretory and osmoregulatory organs.
- (f) Primitive and advanced nervous systems.
- (g) Reproduction: Asexual, sexual and parthenogenesis.
- (h) Larval forms.

### UNIT- III: Structural organization of Chordates:

- (a) Protochordates, Balanoglossus, Herdmania, Branchiostoma.
- (b) Comparative anatomy of integument, skeletal, digestive, respiratory, circulatory, urinogenital & nervous systems of vertebrates.
- (c) Adaptation in vertebrates (fishes, amphibians, reptiles, birds and mammals).
- (d) Economic importance of chordates.

### UNIT- IV: Developmental Biology:

- (a) Gametogenesis
- (b) Fertilization.
- (c) Early embryonic developments (Cleavage, Blastulation, Fate maps, Morphogenetic movements, Gastrulation).
- (d) Organisers and Organogenesis.
- (e) Development of Frog and Chick including Metamorphosis.
- (f) Formation of extra embryonic membranes in Chick.
- (g) Function and types of placenta in mammals, gestation and Parturition.
- (h) Cell differentiation and teratogenesis.
- (i) Sex differentiation in humans.

### **UNIT- V: Genetics:**

- (a) Mendelian laws of inheritance, recombination, linkage, linkage maps and crossing over, Multiple alleles, gene interaction.
- (b) Mutation – Natural and induced mutations. Chromosome number and forms, structural rearrangements; Polyploidy.
- (c) Cytoplasmic inheritance.
- (d) Human genetics – normal and abnormal, pedigree analysis, karyotypes, genes and diseases, eugenics.
- (e) Sex chromosomes and sex determination.
- (f) Quantitative genetics- polygenic inheritance, heritability and its measurements, QTL mapping.

### **UNIT- VI: Evolution:**

- (a) Origin of life; history of evolutionary thoughts.
- (b) Lamarckism and Darwinism. Sources and nature of variations. Natural selection. Hardy-Weinberg law, Causes of speciation.
- (c) Concept of species and sub-species.
- (d) Fossils and their studies, outline of Geological eras. Origin and evolution of man.
- (e) Principles and theories of continental distribution of animals.
- (f) Zoogeographical realms of the world.

### **UNIT- VII: Ethology:**

- (a) Approaches and methods in study of behaviour.
- (b) Proximate and ultimate causation, altruism and evolution- Group selection, kin selection, reciprocal altruism.
- (c) Neural basis of learning, memory, cognition, sleep and arousal.
- (d) Biological clocks, Development of behaviour, Social communication; Social dominance; Use of space and territoriality. Aggressive behaviour.
- (e) Parental investment and Reproductive success; Parental care, Mating systems.
- (f) Habitat selection and optimality in foraging; Migration, orientation and navigation; Domestication and behavioural changes.

### **UNIT- VIII: Cellular Organization and Molecular Biology**

- a. Structure and function of cell and cytoplasmic constituents: Structure of nucleus, mitochondria, Golgi bodies, endoplasmic reticulum, lysosomes and ribosomes. Cell cycle and cell division.
- b. Membrane structure and function: Structure of model membrane, Lipid bilayer and membrane protein, diffusion, osmosis, ion channels, Active transport membrane pumps, mechanism of solving and regulations of intracellular transport, Electrical properties of membrane.
- c. Structure and types of nucleic acids.
- d. DNA replication, repair and recombination (Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extra chromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination).

- e. RNA synthesis and processing (transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport).
- f. Protein synthesis and processing (Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Posttranslational modification of proteins).
- g. Control of gene expression at transcription and translation level (regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing).

### **UNIT- IX: Cell Cell Communication**

- a. Cellular communication: Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.
- b. Cell signaling: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component systems, light signaling in plants, bacterial chemotaxis and quorum sensing.
- c. Cancer: Changes in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.

### **UNIT- X: Biological Techniques and Biotechnology**

- a. Microscopic techniques: Light microscopy, Confocal, Fluorescence, Phase contrast, Electron and Atomic force microscopes and image processing methods in microscopy.
- b. Histochemical staining of Nucleic acids and Enzymes. Antibody generation, ELISA, RIA, Blotting techniques, Immunocytochemical techniques, FISH, GISH.
- c. Radiolabelling Techniques; Types and properties of Radio isotopes, Tracer techniques, Autoradiography and safety guidelines.
- d. Electrophoresis, Centrifugation, Chromatography, Colorimetry, Spectrophotometry.
- e. Isolation and purification of RNA, DNA (genomic and plasmid) and proteins. Different separation methods.
- f. Analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, Isoelectric focusing gels.
- g. Molecular cloning of DNA & RNA fragments in bacterial and eukaryotic systems.
- h. Expression of recombinant proteins using bacterial, animal and plant vectors.
- i. Isolation of specific nucleic acid sequences, Generation of genomic and cDNA libraries.
- j. Plasmid, phage, cosmid, BAC and YAC vectors.
- k. In vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms.
- l. Protein sequencing methods, detection of post translation modification of proteins. DNA sequencing methods, strategies for genome sequencing.
- m. Methods for analysis of gene expression at RNA and protein level, large scale expression, such as micro array based techniques.
- n. Isolation, separation and analysis of carbohydrate and lipid molecules.

- o. RFLP, RAPD and AFLP techniques.
- p. Statistical applications in Biology – Mean, Median, Mode, Student's 't' test, Chi square test, Standard Deviation. Correlation and Regression, Variance and Analysis of Variance. Computer applications in biology – fundamentals of computers.

#### **UNIT- XI: Animal Ecology Biodiversity and Wildlife Studies**

- a. Environment - Biotic and Abiotic Components, Population and its Ecology: Characteristics of population, growth curves, regulation. Life history strategies, concept of meta population, demes and dispersal, interdemic, extinction, age structured populations.
- b. Population, interspecific and intraspecific relationships.
- c. Community ecology and succession, concept of ecosystem.
- d. Biogeochemical cycles. Limiting factors. Concepts of habitat and ecological niche.
- e. Major biomes and their communities and Biogeography.
- f. Pollution - its control and management, Biodegradation and Bioremediation.
- g. Concepts, principles and types of biodiversity.
- h. Major Biodiversity areas and hotspot in India.
- i. Conservation and major wild life sanctuaries in Rajasthan.
- j. Rare, Endangered species or Threatened species and their conservation strategies.

#### **UNIT- XII: Human Physiology**

- a. Chemistry of carbohydrates, proteins, lipids and nucleic acids. Enzymes and hormones. Biological oxidation. Metabolism of carbohydrates, proteins and lipids.
  - b. Cell Physiology- Structure, types and mechanism of muscle contraction. Structure of neuron and transmission of axonic and synaptic nerve impulse.
  - c. Functions of sensory organs concerned with vision, sound perception, taste, smell and touch.
  - d. Physiology of Gastrointestinal tract: Contractility, Secretion of digestive juices, GI hormones. Mechanism of digestion and absorption.
  - e. Physiology of Respiration: Pulmonary ventilation and gaseous exchange.
  - f. Structure and Circulation of Blood: Blood structure and functions, blood groups, clotting of blood, elementary idea of immunology. Structure and functions of the heart, Cardiac Cycle, Heart Beat, and its chemical regulation.
  - g. Physiology of Excretion: Kidney structure, urine formation, counter current mechanism, regulation of electrolyte and water balance of the body.
  - h. Endocrine Physiology: Structure, functions of Pituitary, Thyroid, Parathyroid, Adrenal, Islets of Langerhans and pineal gland.
  - i. Physiology of Reproduction: Structure and hormones of Ovary & Testis. Hormonal control of gametogenesis and menstrual cycle.
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