



# **UNIVERSITY OF GOUR BANGA**

(Established under West Bengal Act XXVI of 2007)

N.H.-34 (Near Rabindra Bhawan), P.O.: Mokdumpur,

Dist.: Malda, West Bengal, Pin-732 103

**UG Syllabus and Question Pattern (Honours & General)**

**(Zoology)**

(Under 1+1+1 System)

## Main Feature of the Syllabus

### Zoology (Honours)

Part /	Paper	Revised Paper	MCQ / Descriptive	Marks	Time	Total Marks	Total Time
Part-I	ZHT-I	I-A	MCQ	10	30 Min	50	2.00 Hr
		I-B	Descriptive	40	1.30 Hr		
	ZHT-II	II-A	MCQ	10	30 Min	50	2.00 Hr
		II-B	Descriptive	40	1.30 Hr		
	ZHT-III	III-A	MCQ	10	30 Min	50	2.00 Hr
III-B		Descriptive	40	1.30 Hr			
ZHP-I	IV	Practical	50	4.00 Hr	50	4.00 Hr	
Part-II	ZHT-IV	V-A	MCQ	10	30 Min	50	2.00 Hr
		V-B	Descriptive	40	1.30 Hr		
	ZHT-V	VI-A	MCQ	10	30 Min	50	2.00 Hr
		VI-B	Descriptive	40	1.30 Hr		
	ZHT-VI	VII-A	MCQ	10	30 Min	50	2.00 Hr
VII-B		Descriptive	40	1.30 Hr			
ZHP-II	VIII	Practical	50	4.00 Hr	50	4.00 Hr	
Part-III	ZHT-VII	IX-A	MCQ	10	30 Min	50	2.00 Hr
		IX-B	Descriptive	40	1.30 Hr		
	ZHT-VIII	X-A	MCQ	10	30 Min	50	2.00 Hr
		X-B	Descriptive	40	1.30 Hr		
	ZHT-IX	XI-A	MCQ	10	30 Min	50	2.00 Hr
		XI-B	Descriptive	40	1.30 Hr		
	ZHT-X	XII-A	MCQ	10	30 Min	50	2.00 Hr
		XII-B	Descriptive	40	1.30 Hr		
	ZHT-XI	XIII-A	MCQ	10	30 Min	50	2.00 Hr
		XIII-B	Descriptive	40	1.30 Hr		
ZHP-III	XIV	Practical	50	4.00 Hr	50	4.00 Hr	
ZHP-IV	XV	Practical	50	4.00 Hr	50	4.00 Hr	
ZHF-I	XVI	Project Work	50	4.00 Hr	50	4.00 Hr	

### Zoology (General)

Part /	Paper	Revised Paper	MCQ / Descriptive	Marks	Time	Total Marks	Total Time
Part-I	ZGT-I	I-A	MCQ	10	30 Min	50	2.00 Hr
		I-B	Descriptive	40	1.30 Hr		
	ZGT-II	II-A	MCQ	10	30 Min	50	2.00 Hr
		II-B	Descriptive	40	1.30 Hr		
ZGP-I	III	Practical	50	4.00 Hr	50	4.00 Hr	
Part-II	ZGT-III	IV-A	MCQ	10	30 Min	50	2.00 Hr
		IV-B	Descriptive	40	1.30 Hr		
	ZGT-IV	V-A	MCQ	10	30 Min	50	2.00 Hr
		V-B	Descriptive	40	1.30 Hr		
ZGP-II	VI	Practical	50	4.00 Hr	50	4.00 Hr	
Part-III	ZGT-V	VII-A	MCQ	10	30 Min	50	2.00 Hr
		VII-B	Descriptive	40	1.30 Hr		
	ZGP-III	VIII	Practical	50	4.00 Hr	50	4.00 Hr

❖ Revised Paper Code as treated Official Paper Code

**Gross Description of Papers and Allotted Marks**

Part	Paper	Unit	Marks	Total Marks
I	ZHT-I	1: Life and Diversity: Protozoa to Annelida	25	50
		2: Life and Diversity: Arthropoda to Hemichordata	25	
	ZHT-II	1: Life and Diversity: Urochordates to Mammals	25	50
		2: Life and Diversity: Comparative anatomy and Special features	25	
	ZHT-III	1: Applied Zoology	25	50
		2: Conservation Biology and Wild life, Biostatistics and Bioinformatics	25	
ZHP-I	Laboratory course (practical)	50	50	
<b>Total</b>				<b>200</b>
II	ZHT-IV	1: Histology and Histochemistry	25	50
		2: Microscopy and Analytical Techniques	25	
	ZHT-V	1: Cell Biology	25	50
		2: Genetics	25	
	ZHT-VI	1: Animal Physiology	25	50
		2: Biochemistry	25	
ZHP-II	Laboratory course (practical)	50	50	
<b>Total</b>				<b>200</b>
III	ZHT-VII	1: Taxonomy and Animal Behaviour	25	50
		2: Adaptation and Evolution	25	
	ZHT-VIII	1: Microbiology and Immunology	25	50
		2: Parasitology and Medical Zoology	25	
	ZHT-IX	1: Ecology	25	50
		2: Environmental Biology and Toxicology	25	
	ZHT-X	1: Molecular Biology	25	50
		2: Biotechnology	25	
	ZHT-XI	1: Developmental Biology and Teratology	25	50
		2: Endocrinology and Reproductive Biology	25	
	ZHP-III	Laboratory course (practical)	50	50
ZHP-IV	Laboratory course (practical)	50	50	
ZHF-I	Field study and Project work	50	50	
<b>Total</b>				<b>400</b>
<b>Grand Total</b>				<b>800</b>

**PART: I**

***Paper ZHT-I***

**Unit 1: Life and Diversity: Protozoa to Annelida**

**25 marks**

- Five kingdom classification of living organisms
- Characteristic features and classification of kingdom Protista up to Phyla
- Characteristic features and classification of the Phyla: Porifera, Cnidaria, Ctenophora, Platyhelminthes, Aschelminthes and Annelida (upto sub classes)
- Type study (morphology, reproduction and life cycle)
  - Paramecium* sp
  - Scyphasp*
  - Obeliasp*
  - Hormiphorasp*
  - Fasciola hepatica*
  - Ascarislumbricoides*
  - Metaphire(=Pheretima) pasthuma*
- Special features
  - Brief idea about organism, compartmentalization, polarity and cell specialization of Metazoa
  - Comparative study of locomotion and nutrition in *Euglena* sp., *Paramecium* sp. and *Amoeba* sp
  - Canal system in Porifera
  - Types, distribution and conservation of corals and coral reefs

- (e) Polymorphism in Siphonophora
- (f) Types, origin and significance of coelom
- (g) Evolution and significance of segmentation in annelids
- (h) Excretion in Annelida
- (i) General idea about Rotifera and Sipuncula
- (j) Structure and significance of trochophore larva

**Unit 2: Life and Diversity: Arthropoda to Hemichordata**

**25 marks**

1. Characteristic features and classification of the Phyla: Arthropoda (upto classes), Mollusca (upto subclasses), Echinodermata (upto living subclasses) and Hemichordata (upto classes)
2. Type study ( morphology, reproduction and life cycle)
  - (a) *Periplaneta americana*
  - (b) *Pilaglobosa*
  - (c) *Asterias*
  - (d) *Balanoglossus*
3. Special features
  - (a) Exoskeleton, vision and mouthparts in arthropods
  - (b) Metamorphosis in insects with hormonal regulation
  - (c) Life cycle and parasitic adaptation of *Saccalinus*
  - (d) Torsion in Gastropoda
  - (e) Salient features and affinities of Onychophora and Xiphosurians
  - (f) Salient features i) Brachiopoda ii) Bryozoa iii) Chaetognatha
  - (g) Water vascular system in echinoderms
  - (h) Study of larval features of phylum Mollusca and phylum Echinodermata

**Paper ZHT-II**

**Unit 1: Life and Diversity: Urochordates to Mammals**

**25 marks**

1. Fundamental, general and advanced chordate features
2. Characteristic features and classification of chordates up to—
  - (a) Super Orders: Chondrichthyes, Osteichthyes and Aves
  - (b) Infra Classes: Mammalia
  - (c) Orders: Amphibia and Reptilia
  - (d) Sub Classes: Cyclostomata
3. Type study
  - (a) *Branchiostomalanceolatum*— morphology, primitive, degenerative and specialized features
  - (b) *Ascidia*— morphology and retrogressive metamorphosis
  - (c) *Petromyzon*— primitive, degenerative and specialized features
  - (d) *Scoliodon*— morphology; respiratory and digestive system
  - (e) *Duttaphrynus (=Bufo) melanostictus*— morphology; respiration, life-cycle and metamorphosis
  - (f) *Calotes versicolor*— morphology; reproductive system
  - (g) *Columba livia*— morphology; respiration
4. Special features
  - (a) Structure of ammocoete larva and its evolutionary significance
  - (b) Salient features, adaptations, distribution and affinities of Dipnoi
  - (c) Swim bladder and accessory respiratory organs in fishes
  - (d) Poisonous and non-poisonous snakes, poison apparatus and biting mechanism; types of venoms
  - (e) Anatomical peculiarities and evolutionary position of *Sphenodon*
  - (f) Birds flight— aerodynamic principle and flight mechanism in birds; perching
  - (g) Anatomical peculiarities and phylogenetic relationship of Monotremata and Marsupialia
  - (h) Salient features of some mammalian Orders: (a) Cetacea, (b) Sirenia, (c) Artiodactyla, (d) Perissodactyla, (e) Proboscidea, (f) Primates

**Unit 2: Life and Diversity: Comparative anatomy and special features**

**25 marks**

1. Comparative anatomy and some important feature of birds and mammals

- (a) Exoskeletal structure and its derivatives in fishes, reptiles and birds and mammals (scales, feathers, hairs, hooves, horns and claws)
  - (b) Integumentary glands in vertebrates
  - (c) Digestive system: Comparative anatomy of stomach in vertebrates
  - (d) Circulatory system: Aortic arches and heart in vertebrates
  - (e) Nervous system: General plan and comparative account of brain in vertebrates
  - (f) Excretory system: Comparative anatomy of kidney in vertebrates.
2. Important Features and significance
    - (a) Electric organ in fishes
    - (b) Neoteny and Paedogenesis with special reference to Axototl larva
    - (c) Echolocation in mammals
    - (d) Dentition in mammals

**Paper ZHT-III**

**Unit 1: Applied Zoology**

**25 marks**

1. Basic idea of pests and insecticides, idea about integrated pest management
2. Life history, damage and control measures of the following pests:
  - (a) *Leptocorisaacuta*
  - (b) *Sitophilusoryzae*
  - (c) *Anomissabolifera*
  - (d) *Leucinodesorbinalis*
  - (e) Mango pest
3. *Bandicotabengalensis*: Biology; damage caused by the pest and its control measures
4. Aquaculture:
  - (a) Induced breeding of carps, air breathing fishes
  - (b) Knowledge of fish seed transport; fish diseases – their symptoms and remedies with special reference to epizootic ulcerative syndrome
  - (c) Giant fresh water prawn culture
  - (d) Pearl culture – pearl producing oysters and their distribution, composition of pearl.
5. Sericulture: silk worm species and their host plants— mulberry silkworm, different races; brief idea of silk worm rearing; extraction and reeling of silk; diseases and enemies of silk moths; concept on non-mulberry sericulture
6. Apiculture: types of honey bees, modern methods of apiary management; composition of honey and its uses
7. Sustainable utilization of biodiversity resources
8. Breeding livestock (Cow, goat), marker assisted selection
9. Production of transgenics and their uses in health and agriculture.

**Unit 2: Conservation Biology and Wild life, Biostatistics and Bioinformatics**

**25 marks**

1. Conservation Biology and Wild life
  - (a) Causes of loss of Indian wild life; current status of threatened mammals, birds, reptiles, amphibians, butterflies from India
  - (b) Principles of conservation and management of endangered species
  - (c) Conservation project on tiger, rhinoceros, Lion and hollock gibbon
  - (d) State diversity board, national biodiversity authority, convention on biodiversity
  - (e) Wild life Sanctuary, national park, biosphere reserve objectives and process of creation
2. Biostatistics and Bioinformatics
  - (a) Basic idea on variables, frequency distribution and sampling
  - (b) Measures of central tendency: mean, median, mode
  - (c) Measures of distributions: variance, standard deviation and standard error—problems and application
  - (d) Nucleotide sequences data bases: EMBL, DDBJ, gene bank, protein sequence data base –Swiss Prot, PIR
  - (e) NCBI, EBI, RasMol, Clustal X (basic idea only)

1. Demonstration of dissection: cockroach (different systems)
2. Demonstration of dissection: white rat (different systems)
3. Identification (with reasons and systematic position of adults to be mentioned)
  - (a) Non-chordates: *Amoeba, Euglena, Paramoecium, Hydra, Scypha, Obelia, Aurelia, Physalia, Metridium, Fasciola, Taeniasolium, Ascaris, Neries, Hirudinaria, Chaetopterus, Aphrodite, Peripetus, Lepas, Balanus, Eupagurus, Hippa, Squilla, Prawn, Crab, Carcinoscormim* (horse shoe crab), *Mantis, Chiton, Patella, Mytilus, Sepia, Loligo, Octopus*, Sea star, Sea Lily, Brittle star, Sea cucumber, Sea urchin, *Balanoglossus* (virtual and museum specimens)
  - (b) Chordates: *Ascidia, Doliolum, Branchiostoma, Petromyzon, Myxine, Scolidon, Sphyrna, Trygon, Torpedo, Labeorohita, Catlacatla, Cirrhinus mrigala, Mugilparsia, Tenuialosa (Hilsa) ilisha, Heteropneustes, Clarias, Exocoetus, Syngnathus, Ichthyophis, Rana, Tylototriton, Rhacophorus, Trionyx, Gecko, Calotes, Necturus, Draco, Hydrophis, Chamaeleon, Naja, Daboia (= Vipera), Psittacula, Passer, Pycnonotus, Dinopium, Pteropus, Funambulus, Cavia, Moschus, Hoolock* (virtual and museum specimens)
  - (c) Larval identification: *Ephyra, Nauplius, Zoea, Mysis, Megalopa, Glochidium, Trochophore, Veliger, Bipinnaria, Ammocoete*, Tadpole, Axolotl
  - (d) Identification of vectors and pests (virtual or dead/museum specimens)
  - (e) Identification of bones: skull (Toad, *Chelonia, Calotes*, poisonous snake, *Columba, Cavia*), appendicular bones (*Columba, Cavia*), girdle bones: *Columba, Cavia*) and vertebrae (*Columba, Cavia*)
4. Behavioural/habitat study of chordate/non-chordate animals (field and photography only)
5. Application of statistics in Zoology: determination of t-test, Chi-square and level of significance (simple problems to be set in classes and examinations)
6. Laboratory note book
7. Viva voce

**Suggested reading:** Books, Periodicals and Journals covering the topics of the syllabus and as suggested by the College Teachers

## **PART: II**

### **Paper ZHT-IV**

#### **Unit 1: Histology and Histochemistry**

**25 marks**

1. Histology
  - (a) Fixatives and fixation: principle, types and procedure
  - (b) Dyes and stains used in histology (classification, composition and properties); principle of staining: double and triple staining methods of histological tissue sections; mordents and metachromatic dyes
  - (c) Histological and functional aspects of lung, liver, Kidney, pituitary, thyroid, adrenal, testis and ovary in mammals
  - (d) Histological organization of different parts of mammalian alimentary canal
  - (e) Tissue structure and function: brain, skin, blood, lymph node, bone and muscles
2. Histochemistry
  - (a) Histochemistry as a tool in morphological analysis: tissue sampling, fixation, staining and assessment.
  - (b) Histochemical staining for carbohydrates (PAS), protein (Millon's staining method), lipids (Sudan black-B method); histochemical study of mucosubstances.
  - (c) Fuelgen nuclear staining technique for DNA.
  - (d) Immunohistochemistry: techniques of immunohistochemical staining and applications.

#### **Unit 2: Microscopy and Analytical techniques**

**25 marks**

1. Microscopy: working principle, uses/applications— light, electron (SEM and TEM), phase contrast and fluorescence microscopy.

2. Colorimetry, spectrophotometry, separation techniques, cell fractionations (homogenization and centrifugation), chromatography (paper, TLC, HPLC), electrophoresis (PAGE and agarose gel)— working principles (techniques) and applications only

### ***Paper ZHT-V***

#### **Unit 1: Cell Biology**

**25 marks**

1. Plasma membrane: ultra-structure, fluid mosaic model; functions—permeability, osmosis, passive transport, active transport, endocytosis, exocytosis
2. Cytoskeleton and cell motility: microtubules and microfilaments— role in cell organization, division and motility
3. Spindle apparatus and synaptonemal complex
4. Morphology, ultrastructure and function: endoplasmic reticulum, mitochondria, Golgi complex, ribosome, lysosome and centrosome
5. Chromatin/Chromosome: nucleosome concept; B-chromosome, polytene chromosome, lamp-brush chromosome.
6. Nucleic acids: physico-chemical properties, structures types and functions of DNA and RNA
7. Cell cycle, mitotic and meiotic cell divisions and their significance

#### **Unit 2: Genetics**

**25 marks**

1. Basic principles of heredity: Mendel's law segregation and concept of dominance; Mendel's dihybrid crosses and law of independent assortment.
2. Criteria of genetic materials: DNA as the genetic material (experiments of Griffith; Hershey and Chase experiment, and experimental protocol of Avery, MacLeod and McCarty)
3. Sex determination and dosage compensation in *Drosophila* and man.
4. Linkage and crossing over; sex linked inheritance in man and *Drosophilamelanogaster*; sex limited characters and cytoplasmic inheritance
5. Chromosomal aberrations: structural variations in chromosomes (deletion, duplication, inversion and translocation); variation in chromosome number (aneuploidy, euploidy and polyploidy)
6. Chromosomal basis of genetic disorder and diseases: Down, Turner's and Klinefelter syndromes

### ***Paper ZHT-VI***

#### **Unit 1: Animal Physiology**

**25 marks**

1. Physiology of respiration: mechanism of breathing; transport of O<sub>2</sub> and CO<sub>2</sub> in mammals, Oxy-haemoglobin dissociation curves; Bohr's effect and Haldane effect, chloride shift
2. Cardiovascular system: erythropoiesis; haemoglobin— structure, function and disorders; electrocardiogram and echocardiography— concept and application; blood pressure: hypo- and hypertension; body fluid and edema
3. Renal physiology: physiology of urine formation; glomerular filtration, tubular secretion, plasma clearance, and counter current mechanism
4. Neurophysiology: propagation of nerve impulse through nerve fibres; orthodromic and antidromic nerve impulse; pathophysiology of Alzheimer's disease and multiple sclerosis; sleep and sleep disorders; yoga and meditation
5. Special sense: physiology of vision and hearing in mammals; pain— causes, components and types
6. Physiology of muscle contraction

#### **Unit 2: Biochemistry**

**25 marks**

1. Carbohydrate, protein and lipid: elementary knowledge on types and structures
2. Metabolism of carbohydrates (glycolysis, gluconeogenesis, glycogenolysis and glycogenesis) and proteins (deamination and transamination)
3. TCA cycle, oxidative phosphorylation and electron transport chain
4. Enzymes: classification, kinetics—Michaelis-Menten concept, and factors affecting enzymatic actions; ribozyme

1. Demonstration for determination of human blood pressure
2. Differential counts of WBC and total counts of WBC and RBC in human blood; estimation of haemoglobin in human blood; ABO blood grouping; CT and BT determination (human subject: demonstration only)
3. Human pedigree chart analysis
4. Squash preparation and study of cell division stages: onion root tip (mitotic) and grasshopper (meiotic)
5. Qualitative tests for proteins/carbohydrates/lipids; quantitative estimation of protein
6. pH measurement of various samples (soil and water) using pH meter
7. Microtomy; tissue fixation, cutting, stretching, affixation, staining, microscopic observation and identification (laboratory bred animal)
8. Identification of histological (mammalian) prepared slides with reasons: stomach, ileum, lung, liver, thyroid, kidney, pancreas, testis and ovary
9. Laboratory note book
10. Viva voce

**Suggested reading:** Books, Periodicals and Journals covering the topics of the syllabus and as suggested by the College Teachers

### **PART: III**

#### **Paper ZHT-VII**

##### **Unit 1: Taxonomy and Animal Behaviour**

**25 marks**

1. Taxonomy
  - (a) Taxonomy: micro and macro taxonomy; systematics: application in biology; classification: natural and cladistics; Hierarchy, Taxonomic types
  - (b) Species concept: types and modes; type concept: primary and secondary types— definition and application
  - (c) General idea of codes of zoological nomenclature; Principle of priority; synonym and homonym
  - (d) Cytological, biochemical and molecular taxonomy: basic ideas
2. Animal behavior
  - (a) Basic concept of classical ethology(fixed action pattern, sign stimulus); (orientation/kinesis), innate behavior, simple reflexes, motivation
  - (b) Instinctive and learning behavior; fixed action pattern: communication in honeybees (dance Language and pheromone, sound/bird's singing)
  - (c) Elements of Sociobiology: selfishness, cooperation, altruism and kinship
  - (d) Social organization in termites: eusociality and castes
  - (e) Parental investment (fishes): role of male and female in parental investment; effect, cost and benefit of parental investment; parent-offspring conflict; parental care in amphibians
  - (f) Biological clocks/rhythm: photoperiod and circadian rhythm, fish and bird migration

##### **Unit 2: Adaptation and Evolution**

**25 marks**

1. Adaptation
  - (a) Aquatic adaptation
  - (b) Volant adaptation
  - (c) Fossorial adaptation
  - (d) Scansorial adaptation
  - (e) Cursorial adaptation
2. Evolution
  - (a) Concept of evolution: Hardy-Weinberg equilibrium, calculating allele and genotype frequencies; Founder effect and population bottleneck; genetic diversity and phylogenetic analysis
  - (b) Barriers and dispersals: types and their impact on animal distribution; Zoogeographical realms: names, subdivisions, climatic features and vertebrate fauna

- (c) Origin of life: DNA world and RNA world; theory of evolution— Lamarckism, Darwinism; modern synthetic theory of evolution
- (d) Mimicry and colouration in animals: evolutionary significance; isolation— types and mechanisms; evolution of man; adaptive radiation with special reference to marsupials
- (e) Fossils and fossilization; importance of fossils and dating of fossils

**Paper: ZHT-VIII**

**Unit 1: Microbiology and Immunology**

**25 marks**

1. Outline classification of viruses, bacteria and fungus; structural organization of virus and bacteria.
2. Bacterial growth curve, and bacterial genetics; bacteria culture techniques and culture media: stab culture, streak plate dilution and pour plating; solid and liquid media; selective and enriched media.
3. Transmission, spectrum of illness, diagnosis and treatment: typhoid, cholera and tuberculosis.
4. Rat borne disease: plague and leptospirosis— diagnosis and treatment; food borne and spoilage bacteria: symptoms of the infection and treatment.
5. Body's immune systems: involved cells and tissues; concept on adaptive and innate immunity; activation of B-cells and T-cells; primary and secondary immune responses.
6. Characteristics of antigen and antibody; immunoglobulin types and their functions.
7. ELISA: types and applications; concept on monoclonal and polyclonal antibodies and their applications in medical diagnosis.

**Unit 2: Parasitology and Medical Zoology**

**25 marks**

1. Parasites, parasitism and hyperparasitism: importance of hosts in parasitic development; parasitic adaptations
2. Mode of transmission, diagnosis and control measures of human malaria and taeniasis
3. Life-cycle, pathogenicity and treatment of parasitic infection to humans: *Schistosoma haematobium*, *Entamoeba histolytica* and *Trypanosoma brucei* Gambiense
4. General aspects of host-parasite interaction
5. Zoonosis: mode of infection, risk factors, diagnosis, prevention and control of *Toxocara* infection to humans
6. Tools and techniques of detection of parasite infection to humans: serological, molecular and radiodiagnosis (basic concept only)
7. Biological vectors: Mosquito, Ticks and Reduviid bugs— biology, role in disease transmission and control measures

**Paper: ZHT-IX**

**Unit 1: Ecology**

**25 marks**

1. Ecosystem, ecology and energetics: energy flow and energetic of ecosystem; energy transformations and energy transfer; Law of thermodynamics
2. Biogeochemical cycles: gaseous cycle- carbon and nitrogen cycles; sedimentary cycle
3. Population ecology: properties of population- density, natality, mortality, age distribution, biotic potential, environmental resistance and carrying capacity, population growth forms, J and S shaped curves, migration, emigration and immigration
4. Community ecology: Biotic community- definition, characteristics and classification, species diversity, fluctuations, stratification, succession, ecotone and edge effect
5. Population interactions: Intraspecific and interspecific associations- positive and negative interactions: mutualism, commensalism, parasitism, predation and competition.

**Unit 2: Environmental Biology and Toxicology**

**25 marks**

1. Pollution: Source and effects of major pollutants of air, water and soil
2. Toxicants and public health hazards
  - (a) Toxic chemicals (pesticide, automobile emissions, heavy metals and fertilizers)
  - (b) Level of toxicity— acute, sub acute, chronic; LD<sub>50</sub>, LC<sub>50</sub>
3. Man and Environment
  - (a) Sustainable development (general concept)

- (b) Destruction of habitat and its consequences- wetland, paddy fields, forest, river encroachment, ecological impacts of tourism.
  - (c) EIA (environmental impact assessment): concept
4. Botulism: common bacterial poisoning

**Paper: ZHT-X**

**Unit 1: Molecular Biology**

**25 marks**

1. Molecular structure of DNA and RNA
2. DNA replication: basic rules and requirements; semiconservative mode of replication (Meselson's and Stahl's experiment); types— theta replication, rolling circle replication and linear eukaryotic replication.
3. DNA damage and repair: formation of thymine dimer; nucleotide excision repair and base excision repair.
4. Mutation and mutagens: molecular basis— frame shift mutation, tautomeric shifts (ability to cause mutations); chemical and physical mutagenic agents.
5. Protein synthesis: stages, components and their functions.
6. Molecular biology of cancer: proto oncogenes and their activation; tumor suppressor genes; apoptosis mechanisms

**Unit 2: Biotechnology**

**25 marks**

1. Recombinant DNA technology: role of restriction endonucleases in recombinant DNA formation and gene cloning; molecular vectors used in the rDNA technology and their importance (plasmid, cosmid, phagemid, yeast artificial chromosomes)
2. Biotechnological tools for protein and DNA analysis: Western and Southern blot analysis; PCR— requirements, types and application; DNA finger printing and cDNA library construction
3. Medical biotechnology: hybridoma technology and gene therapy— basic concept and application; vaccines and vaccination— concept and applications of attenuated (live) and inactivated (killed) vaccines, toxoid and DNA vaccines
4. DNA sequencing and DNA microarray: techniques and applications
5. Cell culture techniques: primary and secondary cell cultures; cell lines: definition, development and maintenance; cryopreservation of cells and tissues
6. Environmental and food biotechnology: application of tools and techniques in bioremediation (pesticide only), water purification (drinking water) and food preparation (curd and cheese)

**Paper: ZHT-XI**

**Unit 1: Developmental Biology and Teratology**

**25 marks**

1. Gametogenesis: Process of spermatogenesis and oogenesis, structure of male and female gametes
2. Fertilization: External fertilization; physical and chemical events of fertilization in sea urchin; capacitation and prevention of polyspermy in mammals; in vitro fertilization
3. Eggs: classification based upon the amount and distribution of yolk and presence and absence of shell; egg membranes
4. Cleavage: types with examples based on plane of division and amount of yolk; development and patterns of cleavage; parthenogenesis: types and significance
5. Development of frog: cleavage, blastulation, fate map, gastrulation, neuralation and notochord formation, mesoderm and coelom formation, hormonal control and metamorphosis
6. Development of chick: structure of egg, cleavage, blastulation and fate map, gastrulation; development and function of extra-embryonic membranes
7. Development of heart, kidney, eye and brain in chick
8. Placentation: type; physiology and formation of placenta in human; functions of placenta
9. Organiser concept; nature of inductive substances; and regeneration— outline idea; ageing and apoptosis: significance
10. Teratology: environmental disruption of animal development (alcohol, drugs, nicotine and chemicals)

**Unit 2: Endocrinology and Reproductive Biology****25 marks**

1. Classification of hormones, and mechanism and effect of hormonal actions
2. Hormonal regulation of physiological processes: basic idea and methods with special reference to carbohydrate and calcium metabolism
3. Biosynthesis and secretion of adrenal, ovarian, testicular and thyroid hormones; factors influencing hormone secretion
4. Endocrine disorders with special reference to thyroid gland
5. Corpora allata, corpora cardiaca and neurosecretory cells in insects with special reference to insect metamorphosis
6. Reproductive cycles: oestrous and menstruation cycles and their hormonal regulation
7. Pregnancy: different stages; parturition
8. Hormonal regulation of gametogenesis in mammals

**Paper ZHP-III: Laboratory course (Practical)****50 marks**

1. Laboratory study of aggressive behavior of fighting fishes (killing of organisms not allowed)
2. Preparation of liquid and solid media (broth, stab, slant and plate) for bacteria culture
3. Mixed and pure bacteria culture (streak dilution method) from water and curd (demonstration)
4. Gram-staining of curd bacteria
5. Study of gut parasites from cockroach (demonstration)
6. Gel electrophoresis: submarine and vertical
7. Demonstration for identification and localization of endocrine glands in mammal (laboratory bred)
8. Laboratory note book
9. Viva voce

**Paper ZHP-IV: Laboratory course (Practical)****50 marks**

1. Determination of toxicity of permissible agents: (a)  $LC_{50}$  against stored grain pests/mosquito larvae; (b)  $LD_{50}$  against air breathing fishes (demonstration only) (graphical presentation required in both cases)
2. Determination of dissolved oxygen and carbon dioxide in water
3. Determination pH of soil and water (at least three samples of each type from different sites to be studied)
4. Studies on zooplankton/zoogeographical fauna
5. Preparation of curd, cheese and lassi (demonstration), pasteurization of milk
6. Demonstration for preparation and identification of whole mounts of chick embryo 24, 48, 72 and 96 h)
7. Identification: prepared slides of embryological tissue sections (chick embryo)
8. Laboratory note book
9. Viva voce

**Paper ZHF-I: Field study and Project work****50 marks**

**Suggested reading:** Books, Periodicals and Journals covering the topics of the syllabus and as suggested by the College Teachers

# Zoology General Syllabus

## Gross Description of Papers and Allotted Marks

Part	Paper	Unit	Marks	Total Marks
I	ZGT-I	1: Life and Diversity of non-Chordates	25	50
		2: Life and Diversity of Chordates	25	
	ZGT-II	1: Ecology, Environmental Biology, Wild-life and Animal Behaviour	25	50
		2: Taxonomy & Systematics and Evolution	25	
	ZGP-I	Laboratory course (Practical)	50	50
<b>Total</b>				<b>150</b>
II	ZGT-III	1: Histology, Cell Biology and Genetics	25	50
		2: Developmental Biology and Endocrinology	25	
	ZGT-IV	1: Molecular Biology and Biotechnology	25	50
		2: Animal Physiology and Biochemistry	25	
	ZGP-II	Laboratory course (Practical)	50	50
<b>Total</b>				<b>150</b>
III	ZGT -V	1: Applied Zoology and Biostatistics	25	50
		2: Microbiology, Parasitology and Immunology	25	
	ZGP-III	Laboratory course (Practical)	50	50
<b>Total</b>				<b>100</b>
<b>Grand Total</b>				<b>400</b>

### PART-I

#### **Paper: ZGT-I**

#### **Unit 1: Life and Diversity of Non-Chordates**

**25 marks**

1. Salient features and classification with suitable examples of Sub-Kingdom Protozoa (upto phylum) and Porifera, Cnidaria, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata ( upto Class)
2. Type study:
  - a. *Paramecium* : General morphology and reproduction.
  - b. *Scypha* (= *Sycon*) : Canal system, spicules and reproduction ( gemmules)
  - c. *Obelia* : General morphology and life history
  - d. *Fasciola*: Morphology, life cycle and parasitic adaptations.
  - e. *Ascaris*: Sexual dimorphism, life cycle and parasitic adaptations.
  - f. *Metaphire* (= *Pheretima*) :Locomotory, excretory and reproductive system.
  - g. *Periplaneta*: Respiratory and reproductive system.
  - h. *Pila*: Respiratory and nervous system.
  - i. *Asterias*: Water vascular system, tube feet and locomotion.
3. Special features:
  - a. Locomotory organs and process of locomotion in Protozoa
  - b. Coral and coral reef.
  - c. Structure and significance of Trochophore, Nauplius and Bipinnaria larva.
  - d. Morphology and ciliary mode of feeding in Balanoglossus.

#### **Unit 2: Life and Diversity of Chordates**

**25 marks**

1. Salient features and classification of phylum chordata ( upto Classes)  
Distinctive characters and suitable examples of the living forms of Chondrichthyes and Osteichthyes (upto Subclass), Amphibia and Reptilia( upto living Orders), Aves ( upto Subclass) and Mammalia ( Upto Infraclass).
2. Type study:
  - a. *Branchiostoma*: general organization and mechanism of feeding.
  - b. *Scoliodon* : Morphology and respiration.
  - c. Toad: respiratory, circulatory and urino-genital system.
  - d. *Calotes*: Morphology and reproduction.
  - e. *Columba*: Exoskeleton, flight muscles and respiratory system.

- f. *Cavia*: Nervous system.
3. Special features:
  - a. Comparative anatomy of gut, heart, kidney and brain of *Channa*, Toad, *Calotes*, *Columba* and *Rattus*.
  - b. Scales and fins in fishes.
  - c. Parental care in amphibia.
  - d. Poisonous and non-poisonous snakes, poison apparatus and biting mechanism.
  - e. Aerodynamics in birds.
  - f. Echolocation in bat.

**Paper: ZGT-II**

**Unit 1: Ecology, Environmental Biology, wild life and Animal Behaviour**

**25 marks**

1. Concepts of ecology and ecosystem.
2. Food chain, food web, ecological pyramid and energy flow.
3. Ecological factors: temperature, light, edaphic factors and their effects on organisms.
4. Population ecology: natality, mortality, growth forms, age pyramids, distribution types and regulation of population density.
5. Community ecology: characteristics, types, habitat and niche concept.
6. Concepts of pollution and pollutants.
7. Sources, effects and remedies of air, water and soil pollutions.
8. Basic idea of ecotoxicology and xenobiotics. Concept of EIA.
9. Importance of wild life. Introduction to major Indian mammals and birds.
10. Principles of wild life conservation (in situ and ex situ methods); concepts of national park, sanctuary and reserve forest. Concept of endemism.
11. Biodiversity and traditional knowledge: definition, types, measures of conservation. Biodiversity hotspots.
12. Concept of innate and learned behaviour
13. Social organization of termite and honey bees

**Unit 2: Taxonomy & Systematics and Evolution**

**25 marks**

1. Definition of taxonomy, systematics, Linnean hierarchy.
2. Principles of Binomial nomenclature
3. Species concept.
4. Lamarckism, Darwinism and Modern Synthetic theory of evolution.
5. Hardy-Weinberg equilibrium and its applications.
6. Aquatic and Volant adaptations
7. Zoogeographical realms and their characteristic fauna
8. Colouration and Mimicry and their adaptive significance

**Paper: ZGP-I: Laboratory course (Practical)**

**50 marks**

1. Dissection: digestive system, female reproductive system and nervous system of cockroach (demonstration)
2. Dissection: digestive system, afferent branchial system, efferent branchial system, IX-Xth cranial nerves (origin and distribution) of Lata
3. Mounting: mouth parts and salivary apparatus of cockroach; mosquito larvae; fish scales- cycloid, ctenoid, placoid
4. Estimation of dissolved O<sub>2</sub> and CO<sub>2</sub> in water
5. Determination of pH of water (using pH meter)
6. Identification of vertebrate endoskeletons: Toad— all skeletal parts including hyoid apparatus; Pigeon— skull, typical cervical vertebra, synsacrum, pygostyle with free caudal vertebrae, humerus, carpometacarpus, half of pelvic girdle, tibio-tarsus and fibula, tarsometatarsus; Guineapig— skull, lower jaw, atlas, axis, thoracic and lumbar vertebrae, scapula
7. Laboratory note book
8. Viva voce (based preferably on the practical set in the examination)

## PART II

### *Paper: ZGT-III*

#### **Unit 1: Histology, Cell Biology and Genetics**

**25 marks**

1. Basic idea about common fixatives and dyes used in routine histological procedure
2. Histology of Liver, Kidney, Small intestine, Ovary, Testis, Pituitary, Thyroid and Pancreas
3. Ultrastructure and function of plasma membrane, GERL system, ribosome and mitochondria.
4. Chromosome structure and nucleosome concept
5. Cell cycle: phases and regulation
6. Elements of heredity: Mandel's monohybrid and dihybrid crosses
7. Linkage: definition, Complete and Incomplete linkage with examples
8. Crossing over and recombination (genetic and cytological proof)
9. Mutation: Chromosomal changes (structural and numerical) , point mutation, Down's syndrome, Klinefelter syndrome
10. Sex determination in Drosophila and Man
11. Inheritance of sex linked and autosomal genes in man-haemophilia and Thalassemia

#### **Unit 2: Developmental Biology and Endocrinology**

**25 marks**

1. Spermatogenesis, oogenesis and their hormonal regulation
2. Fertilization in Sea-urchin
3. Cleavage: types and pattern, process of cleavage in frog and chick
4. Gastrulation in frog and chick
5. Basic idea about the role of Organizer and induction mechanism during the process of embryonic development
6. Extra-embryonic membranes in Chick
7. Placenta: types and functions
8. Major endocrine glands in mammals and their hormonal functions ( pituitary, thyroid, pancreas, adrenal, testis and ovary)
9. Classification of hormones and elementary idea about mechanism of hormone action
10. Insect endocrine gland (in brief)

### *Paper: ZGT-IV*

#### **Unit 1: Molecular Biology and Biotechnology**

**25 marks**

1. Physical and chemical structure of DNA and RNA
2. Nucleic acid as genetic material
3. Mechanism of Replication, Transcription and Translation in Prokaryotes
4. Elementary idea about regulation of gene expression and Operon concept
5. Oncogene and cancer: basic idea
6. Basic Principles of Genetic engineering and recombinant DNA technology
7. Enzymes used in genetic engineering; concepts of plasmids and cosmids
8. Basic idea about Cell and embryo cloning and their applications
9. Principles of DNA fingerprinting and its use
10. Scope of Genetic engineering for human welfare

#### **Unit 2: Animal Physiology and Biochemistry**

**25 marks**

1. Composition of vertebrate blood; blood clotting and its regulation; ABO blood group and Rh factor
2. Structure and functions of respiratory pigments, mechanism of transport of O<sub>2</sub> and CO<sub>2</sub> in vertebrate body
3. Process of generation of nerve impulse and its transmission along the nerve fibre, mechanism of synaptic transmission
4. Process of Osmoregulation in fish, concept of osmoconformers and osmoregulators.
5. Physical mechanism of urine formation
6. Structure of muscle and mechanism of muscle contraction
7. Definition and classification of carbohydrate, protein and lipid
8. Enzymes: classification, characteristics and mechanism of action
9. Glycolysis, TCA cycle, Glycogenesis, Transamination and Deamination.

1. Differential count of human WBCs
2. Blood pressure measurement in humans
3. Determination of haemoglobin in human blood
4. Determination of human blood group: ABO system including Rh factor
5. Identification with reasons: histological slides of mammalian stomach, ileum, thyroid, liver, pancreas, kidney, testis, ovary, spleen, lung; chick embryo slides: 24, 48, 72 and 96 hours
6. Biostatics: problems to be set based on the theoretical syllabus
7. Laboratory note book
8. Viva voce (based preferably on the practical set in the examination)

### **PART-III**

**Paper: ZGT-V**

**Unit 1: Applied Zoology and Biostatistics**

**25 marks**

1. Pest and pest management: Definition and types of pest; morphology, life history, behaviour, nature of damage and control measures of the following pests-
  - (a) Paddy pest: *Scirpophaga incertulus*
  - (b) Jute pest: *Apion corchori*
  - (c) Stored grain pest: *Sitophilus oryzae*
  - (d) Vegetable pest: *Leucinodes orbonalis*
  - (e) Mango pest
  - (f) Vertebrate pest: *Bandicota bengalensis*
2. Chemical, biological, hormonal and pheromonal control mechanisms of pests. General idea about IPM
3. Apiculture: Indian honey bees, modern methods of apiculture, honey and its uses
4. Sericulture: Types of silkworms and their food plants, life history and rearing of Mulberry silkworm, harvesting and processing of cocoons, reeling and extraction of silk, common diseases of *Bombyxmori* and their control measures
5. Aquaculture: Basic ideas about different types of aquaculture-monoculture, polyculture, induced breeding, integrated fish farming, prawn culture, pearl culture. Common fish diseases.
6. Poultry: Common indigenous and exotic poultry breeds and their characteristics. Principles and management of poultry (deep litter system), Poultry diseases and their control
7. Dairy: Common Indian and foreign dairy breeds of milching cows, Milk processing( Pasteurization)
8. Biostatistics: Sample, frequency distribution, histogram; definition and calculation of mean, median, mode, standard deviation and standard error ( problems to be solved).

**Unit 2: Microbiology, Parasitology and Immunology**

**25 marks**

1. Outline classification of bacteria and virus.
2. Food and water borne infections-cholera and typhoid.
3. Interspecific associations-symbiosis, commensalism, mutualism and parasitism.
4. Life cycle of *Plasmodium vivax*, *Ascarislumbricoides*, *Wuchereriabancrofti*-their pathogenicity and treatment.
5. Parasitic adaptations of *Fasciola* and *Taenia*
6. Role of Mosquito, Sand fly, house fly, cyclops, cockroach, flea, ticks, mites and rats in transmission of diseases.
7. Concept of Innate and adaptive immunity
8. Basic idea of antigens, types and structure of immunoglobulins, antigen- antibody reactions
9. Structure and mechanism of transmission of HIV
10. Principles of Vaccination and types of vaccines

**Paper: ZGP III: Laboratory course (Practical)**

**50 marks**

1. Study of human blood film: identification of leucocytes
2. Study of fecal smear/gut content smear of cockroach for parasites
3. Collection and identification of animals: preservation of any five parasites and five pests (major/minor)

4. Histological slide preparation of mammalian (laboratory breed) tissue, staining (double staining method) and identification: liver, kidney, intestine)
5. Identification of prepared slides: zooplanktons and phytoplanktons
6. Identification of microfilaria larva; type specimen: *Taenia solium*, *Scirpophaga incertulus*, *Sitophilus oryzae*, *Leptocorisa*, *Epilachna*, *Coccinella*, *Lepisma*, Termite, *Bandicota* sp., *Labeo rohita*, *L. bata*, *Catla catla*, *Cirrhinus mrigala*, *Hypophthalmichthys molitrix*, *Ciprinus carpio*, *Ctenopharyngodon idela*, *Tenuulosa (=Hilsa) ilisha*, *Penaeus*, *Macrobrachium rosenbrgi*
7. Laboratory note book
8. Viva voce (based preferably on the practical set in the examination)

**Suggested reading:** Books covering the topics of the syllabus and as suggested by the College Teachers