

# **UTKAL UNIVERSITY**

## **M. Phil. Zoology Examination**

### **SEMESTER SYSTEM**

#### **Effective from the session 2020-21**

1. Candidate with at least second class M.Sc. in Zoology are eligible to apply for admission into the course. The course is of one year duration and consists of two semesters of theory (general and intensive), laboratory and dissertation work. Each theory paper carries 100 marks and will have examination of 4 hours duration. Practical papers carrying 100 marks will be of six hours duration.
2. The first semester will start with the beginning of the academic session or after the admission into the said course as per the university schedule.
3. Examination for the 1<sup>st</sup> and 2<sup>nd</sup> semesters will be held at the end of the respective semesters or may be held together at the end of the session. Once a candidate selects a group from A-F in the paper Zoo-MP-502, the same group becomes obligatory for her/him in the paper Zoo-MP-602.
4. The semester system of the examination will have internal system of valuation for theory papers. The practical paper will be examined by internal examiner and one external examiner. If necessary the practical examination may be extended to the next day.
5. The Members of Teacher's council constitutes the conducting board for this course.
6. Answer Scripts of the theory papers of the semesters will be evaluated by the teacher(s) teaching in the department.
7. A student is required to prepare a dissertation carrying 100 marks. She/He may start the dissertation project in consultation with her/his supervisor from the beginning of the 1<sup>st</sup> semester. But the dissertation will be submitted at the end of the 2<sup>nd</sup> semester. The dissertation will be examined by an external examiner and the respective supervisor. The candidate is required to present the dissertation in power point during the examination
8. To pass the M.Phil. Examination the candidate has to secure a minimum of 50% marks each in theory, practical and dissertation papers. The pass mark in aggregate is also 50%.
9. If the candidate passes both the semester examinations, she/he will be declared to have passed the M. Phil. (semester) examination in Zoology.
10. In order to be eligible to appear at the university examination, a student has to secure at least 75% of attendance.

## SYLLABUS OF M.Phil. ZOOLOGY 2020-21

### Semester I

Course No.	Course Title	Marks
Zoo-MP-501	General Theory-I	100
Zoo-MP-502	Intensive Theory-I (any one from A-F)	100
Zoo-MP-503	Practical (Covering MP-501)	100
<b>Total</b>		<b>300</b>

### Semester-II

Course No.	Course Title	Marks
Zoo-MP-601	General Theory-II	100
Zoo-MP-602	Intensive Theory-II (as per the group selected in Sem. I)	100
Zoo-MP-603	Dissertation	100
<b>Total</b>		<b>300</b>
<b>Grand Total</b>		<b>600</b>

**SEMESTER-I**  
**PAPER-I (Zoo-MP-501)**  
**GENERAL THEORY I**

1. Physiology of olfaction and vision.
2. Variation on chromosomes (aneuploidy, euploidy, polyploidy and application of polyploidy).
3. Pioneering experiments in Developmental Biology.
4. Gene regulation during development.
5. Temperature regulation in poikilothermic and homeothermic animals.
6. Osmoregulation.
7. Important crop pests in agriculture and their control measures.
8. System concept in Ecology.
9. Analytical techniques I: Microarray and gene expression, Cloning and sequencing of genes,
10. Analytical techniques II: SEM and TEM, Fluorescence and Confocal microscopy, LCMSMS, GCMS, FACS.
11. Model animals: (*Caenorhabditis elegans*, *Drosophila*, *Danio rerio*, Amphibian tadpoles, Chick embryos, Mouse, Guinea pig)

**PAPER-II (Zoo-MP-502)**  
**INTENSIVE THEORY I (A-F)**  
**Any one of the following papers**

**Zoo-MP-502 (A)**

**CYTOGENETICS**

1. Intermitotic cycle and mitotic cycle: the molecular mechanism.
2. Mechanism of movement of chromosomes in eukaryotic cells.
3. Chromosomes (Number, Morphology, Karyotype, Euchromatin and heterochromatin, Ultrastructure of chromosomes, Special types of chromosomes, Plasmid and its biological importance).
4. Chromosome mapping in prokaryotes and eukaryotes.
5. Giant chromosomes (polytene chromosome and lamp-brush chromosome).
6. Life cycle and culture of *Drosophila*.
7. Determination of Sex (human and *Drosophila*), Sex linked inheritance in *Drosophila*
8. Genetic Significance of sex (asexual reproduction, evolution of sex, genetic advantage of sexual reproduction).
9. Genetics of Microorganism (recombination in bacterial cell).
10. Mutation (History, General Nature, Types, Causes and fundamental problems of mutation, Radiation and its effect on biological system).
11. Genetics and Behaviour (Communication among bees, Ontogeny, Phylogeny and Heritability of behavior patterns, Role of heredity in behavior of Man).

### **Zoo-MP-502 (B)**

#### **CELL AND DEVELOPMENTAL BIOLOGY**

1. General concept of Vertebrate Embryology.
2. Mechanism of Induction.
3. Organizer concept and its mechanism.
4. Concept of hormonal control during spermatogenesis.
5. Mechanism of spermiogenesis.
6. Hormonal control of oogenesis.
7. Mechanism of regeneration in planaria and amphibia.
8. Homeotic transformation in invertebrates and vertebrates.
9. Natural and artificial parthenogenesis.
10. Axis formation in *Drosophila*

### **Zoo-MP-502 (C)**

#### **ENDOCRINOLOGY AND REPRODUCTIVE PHYSIOLOGY**

1. Homeostatic model for endocrine system.
2. Origin of Endocrine cells.
3. Neuroendocrine mechanism in invertebrates with special reference to Crustacea and Insecta.
4. Pars intermedia and chromatophore regulation.
5. Phylogeny of Neurohypophysial peptides.
6. Hormonal control of lipid metabolism.
7. Calcium and Phosphate Homeostasis.
8. Hormonal control of male reproduction.
9. Hormonal control of female reproduction.
10. Influence of exteroceptive factors on Mammalian reproduction: Light, Temperature and Olfaction (Reproductive Pheromones).

### **Zoo-MP-502 (D)**

#### **ENTOMOLOGY**

1. Origin and Evolution of Insects.
2. Relationship among insect Orders.
3. Phylogeny of Insects.
4. Comparative morphology of insect body parts.
5. Insects of public health nuisance and their management.
6. Ingestion and digestion of food.
7. Insect haemolymph.
8. Organs for elimination of metabolic wastes.
9. Sound production and its significance.
10. Hormonal control of metamorphosis.

### **Zoo-MP-502 (E)**

#### **ENVIRONMENTAL BIOLOGY**

1. Organism and Environmental Complex.
2. Concept of stress and strain.
3. Adaptation and concept of limiting factor.
4. Concept of habitat and niche.
5. Mechanism of adaptation
6. Concept of Model and Ecosystem modeling.
7. Concept of Community: structure, composition, function and stratification.
8. Biodiversity: Concept, species richness and species abundance.
9. Concept and Classification of Resources: Non- renewable resources, renewable resources.
10. Conservation and management of resources, sustainable development.

### **Zoo-MP-502 (F)**

#### **MOLECULAR BIOLOGY**

1. History of Molecular Biology and Genetics.
2. Prokaryotic and Eukaryotic DNA replication: Mechanism, Enzymes and accessory proteins involved in DNA replication.
3. DNA Damage and Repair in prokaryotes and eukaryotes.
4. Transcription: Prokaryotic and Eukaryotic transcription, RNA polymerase, general and specific transcription factors, Regulatory elements and mechanism of transcription regulation, transcriptional and post transcriptional gene silencing.
5. Non coding RNA: miRNA, lncRNA, siRNA- biogenesis, function.
6. Operon system: Lac operon, Ara operon, Trp operon, Gene regulation in eukaryotes.
7. Translation: Prokaryotic and eukaryotic translation mechanism, post- translational modifications of proteins
8. DNA sequencing: Types, methods, next generation sequencing and application.

**PAPER III (Zoo-MP-503)**

**PRACTICAL**

**SEMESTER – II**

**PAPER-I (Zoo-MP-601)**

**GERAL THEORY-II**

1. Antioxidant defense system and oxidative stress.
2. Mitotic apparatus and chromosomal movements during cell division.
3. Reproductive specialization in animals with special reference to vertebrates.
4. Body pattern formation and role of HOX genes
5. Chromatophores in animals.
6. Economic importance of insects.
7. Human population growth and problems
8. Experimental design and data analysis: Positive and negative controls, Sampling design
9. Reading and critical analysis of scientific literature, review on a relevant research topic
10. Intellectual property rights
11. Good laboratory practices, research ethics, plagiarism, CPCSEA guidelines.

**PAPER-II (Zoo-MP-602)**

**INTENSIVE THEORY-II (A-F)**

*Any one of the following papers*

**Zoo-MP-602 (A)**

**CYTOGENETICS**

1. Heredity and Environment in human (Twins, Identical twins, Siamese twins)
2. Cloning (Historical development, Biomedical importance and its future).
3. Stem cells and its biological applications.
4. Human Genome Project
5. Genetic Counseling (Eugenics, Principle, Process, Biomedical importance, Biohazard).
6. Cancerous cell (different types of cancer growth, biology of cancer).
7. Apoptosis and its mechanism and detection.
8. Parthenogenesis (arrhenotoky and hermaphroditism).
9. Gynandromorphism (Gynanders in *Drosophila*, Silk worm and Bees).
10. Principles of Hardy-Weinberg's law and its application in population biology
11. Statistical analysis: Wilcoxon Rank Sum table, Mann-Whitney U test, Kruskal-Wallis Test, Kolmogorov-Smirnov (K-S) test, Principal Component Analysis

### **Zoo-MP-602 (B)**

#### **CELL AND DEVELOPMENTAL BIOLOGY**

1. Transgenic animal.
2. Chimeric animals, mechanism of chimera formation and its applications.
3. Hormonal control of metamorphosis.
4. Different types of growth during embryonic development.
5. Models of cell differentiation.
6. Induced breeding in vertebrates.
7. Developmental anomalies.
8. Cell sorting and isolation of cell components.
9. Role of Fibroblast Growth Factor (FGF) in vertebrate system.
10. Molecular aspects of tadpole tail resorption.

### **Zoo-MP-602 (C)**

#### **ENDOCRINOLOGY AND REPRODUCTIVE PHYSIOLOGY**

1. Renin- Angiotensin system.
2. Endogenous opiates (Enkephalins, Endorphins and Dynorphins).
3. Neuropeptides (Substance P, Neurotensin and Neuropeptide Y).
4. Growth Factors (Nerve Growth Factors, Epidermal Growth Factors and Somatomedins).
5. Etiology and Prognosis of Pituitary disorders (Acromegaly, Gigantism, Dwarfism, Cushing's syndrome).
6. Etiology and Prognosis of Thyroid disorders (Goitre, Cretinism, Myxedema).
7. Sexual Differentiation of the Brain.
8. Assisted Reproductive Technology (IVF, ET, GIFT, ZIFT, TET) and their negative aspects.
9. Endocrine factors and migratory behavior.
10. Phytohormones.

### **Zoo-MP-602 (D)**

#### **ENTOMOLGY**

1. Morphogenesis during development in insects.
2. Social life of insects.
3. Insect and its environment- Effects of biotic and abiotic factors on insect life.
4. Pests and pest management of cultivated crops.
5. Management of stored grain pests.
6. Coloration and mimicry in insects.
7. Symbiotic relationship of insects with microorganisms.
8. Insect vector biodiversity and their role in epidemiology.
9. Molecular techniques in mosquito taxonomy.
10. Insect behavior in response to pheromones.

**Zoo-MP-602 (E)**  
**ENVIRONMENTAL BIOLOGY**

1. Outcome of pollution: Ozone layer depletion, Acid rain, Bio magnification, Green house effect
2. Bioindicators.
3. Soil microfauna, mesofauna and their sampling methods.
4. Biogeochemical cycles.
5. Heavy metals and pesticides in the environment and their impact on organisms.
6. Fresh water habitats- physical and chemical properties.
7. Productivity and Biodiversity in aquatic habitats.
8. Carbon trading, carbon budget and carbon sequestration.
9. Climate change and its impacts on biodiversity, Models for climate change.
10. Habitat differentiation and resource partitioning.

**Zoo-MP-602 (F)**  
**MOLECULAR BIOLOGY**

1. Protein Localization: Synthesis of secretory and membrane proteins, import into nucleus, mitochondria, chloroplast and peroxisomes, receptor mediated endocytosis.
2. Oncogenes and tumour suppressor genes: Viral and cellular oncogenes, tumour suppressor genes from humans, structure, function and mechanism of action of pRB and p53 tumour suppressor genes.
3. Antisense and ribozyme technology: Molecular mechanism of antisense molecules, inhibition of splicing, polyadenylation and translation, disruption of RNA structure and capping, biochemistry of ribozyme – Hammer head, Hairpin and other ribozymes, strategies for designing ribozymes, application of antisense and ribozyme technologies.
4. Recombination: Homologous and non-homologous, Holiday junction, gene targeting, gene disruption, FLP/FRT and Cre/Lox recombination, RecA and other recombinases.
5. Molecular mapping of genome: Genetic and physical maps, Physical mapping and map-based cloning, Choice of mapping population, simple sequence repeat loci, Southern and fluorescence *in situ* hybridization for genome analysis. Chromosome micro dissection and micro cloning, molecular markers in genome analysis: RFLP, RAPD and AFLP analysis, molecular markers linked to disease resistance genes. Application of RFLP in forensic, disease prognosis, genetic counseling, pedigree, varietal etc. Animal trafficking and poaching, germplasm maintenance, taxonomy and biodiversity.
6. Genome Sequencing: Genome sizes, Organelle genomes, Genomic libraries, YAC, BAC libraries for sequencing genome, packaging, transfection and identification of clones, application of sequence information for identification of defective genes, DNA fingerprinting: methods and application; Genome and cDNA library preparation and application.
7. Epigenetics: Mechanism of methylation and acetylation of DNA, genome imprinting and its regulation.

**PAPER-III (Zoo-603) DISSERTATION**