Program Specific Outcomes: PSO of M. Sc., Zoology

* Used the evidences of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They are able to use specific examples to explicate how descent with modification has shaped animal morphology, physiology, life history, and behavior.
* Explicated the ecological interconnectedness of life on earth by tracing energy and nutrient flows through the environment. They are able to relate the physical features of the environment to the structure of populations, communities, and ecosystems.
* Subjects such as invasive or endangered species, embryonic development in mammals and ageing in social insects. Lead to advances in medicine to prevent disease amongst both animals and human beings.
* Developed knowledge and understood of living organisms at several levels of Zoological and Biological organization from the molecular, through to cells and whole organisms and ecosystems all organs of evolutionary perspectives. Importance of fishes and insects for anthrosphere in all perceptions.

Understood how the chemistry and structure of the major biological macromolecules, including proteins and nucleic acids, determines their biological properties.

# M.Sc., ZOOLOGY – COURSE OUTCOMES

# MSc 1st Semester

**COURSE OUTCOMES - PAPER I : NON-CHORDATA**

* Understood the Classification and Phylogeny of Animals, Protozoa to Annelida.
* Described General characteristics, classification of invertebrates .
* Described General characteristics, classification and systematic portion of Minor phyla
* Described the general biology of few selected non-chordates which are useful to mankind?
* Enriched knowledge on Nutrition in Protozoa; Reproduction in Protozoa; Salient features of parasitism in helminthes; Life cycle patterns in helminthes parasites; Adaptive radiation in Polychaeta; Segmental organs in Annelida. Origin of Metazoa; Organization and affinities of Porifera; Polymorphism in Coelenterata; Colony formation in Coelenterata; Coral reefs; Outlines of the ecology of soil nematodes

COURSE OUTCOMES **PAPER II: TECHNIQUES AND TOOLS IN BIOLOGY**

* Understood the Principles and uses of analytical instruments:- Balances, Flame Photometry, Spectrophotomete Spectroflurophotometer, Atomic Absorption Spectrophotometry, Microbial techniques:-Media preparation and Sterilization, Inoculation and growth monitoring, use of fermentations, Microbial assays. Separation and identification of biomolecules by Chromatography:- Paper and thin layer chromatography (TLC), Gas Liquid Chromatography (GLC), Colum chromatography, Ion exchange chromatography, Gelexclusion chromatography, High Performance Liquid Chromatography (HPLC), Affinit chromatography; Separation of biomolecules by electrophoresis; Principles of differential and density centrifugation

# COURSE OUTCOMES – PAPER III : BIOLOGICAL CHEMISTRY

* Identified the five classes of polymeric biomolecules and their monomeric building blocks.
* Explained the specificity of enzymes (biochemical catalysts), and the chemistry involved in enzyme action. Kinetics of enzyme reaction-Kinetics of enzyme- catalyzed reactions, order of enzyme reactions, rate equations, two substrate reactions; Temperature Coefficient, Activation energy; Enzyme inhibition- Competitive and non- Competitive inhibitors; Application of enzyme inhibition techniques in pest control, Allosteric enzymes. Immoblized enzymes and their applications
* Understood types, Structure, biochemical properties and functions of vitamins.
* Explained how the metabolism of organic compounds leads ultimately to the generation of large quantities of ATP. Glycolysis, HMP shunt, b-oxidation of fatty acids, Biosynthesis of glycogen.

# COURSE OUTCOMES PAPER IV- CYTOGENTICS: CLASSICAL AND MOLECULAR

* Described the ultra-structure and functions of cell organelles, Interaction of genes; Cytoplasmic inheritance; Environment and heredity Lethal genes; Sex-linked inheritance; chromosome mapping; Sex chromosome, Sex determination; Numerical and structural chromosome aberrations and their significance
* Understood DNA replication, RNA and protein synthesis and came to know protein synthesis can be controlled at the level of transcription and translation.
* Understood cell signaling and cellular communication.
* Described the oncogenes
* Understood the types and applications of stem cells. Elements of Eugenics, Imprinting of genes, chromosomes and genes and Gene theraphy.

# COURSE OUTCOMES: LAB

* Performed and understood the anatomy and physiology of animals by dissection.
* Understood the anatomy and physiology of invertebrate animals by dissection.
* Described the structural study and mounting of organs.
* Came to knowing the rules of taxonomy and the principle of animal classification.
* Understood the diversity morphology, biological characters and taxonomical importance some selected museum specimens of different animal groups.
* Knowing the various stages of mitosis and meiosis, Study of mitosis and meiosis in onion root tip
* Performed by experiments to analyze estimation of the amino acids by paper chromatographic separation of amino acids.

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# MSc IInd Semester

COURSE OUTCOMES **PAPER – I : HIGHER NON-CHORDATA**

* Understood the Organisation and affinities of Onychophora; Parasitism in Crustacea; Larval forms in Crustacea; Mouth parts of insects; Basic concept of insect pest management;
* Described the Biology and control of *Lepisma; Pediculus, Cimex*; Adaptive radiation in Mollusca; Torsion in gastropods; Larval forms in Echinodermata; Affinities of Echinodermata;
* Described the Brief outlines of the structure and affinities of minor phyla with special reference to Ctenophora, Rotifera, Acanthocephala, Sipunculoidea and Echiuroidea

COURSE OUTCOMES **PAPER – II : ECOLOGY AND ENVIRONMENTAL BIOLOGY**

* Demonstrated an Understood of ecological relationships between organisms and their environment.
* Presented an overview of diversity of life forms in an ecosystem.
* Explained and identified the role of the organism in energy transfers
* Described the Habitat ecology and Resource ecology
* Understood the Environmental Pollution and their management
* Concept of Ecosystem and their types; Marine shores and estuaries; Freshwater; terrestrial; Grassland; Forest, desert and parasitic habitat;
* Described the ecological adaptations, levels, mechanism and significance of body size; Concepts of homeostasis, Environmental stress and strain, acclimation and acclimatization; Conservation of natural resources; wetlands.
* Explained the demography, life tables, generation time, net reproductive rate and reproductive volume; Life history strategies, evolutions of sex and mating systems, optimal size r and k selection population, dynamics and its regulation

COURSE OUTCOMES **PAPER III : COMPARATIVE ANIMAL PHYSIOLOGY**

* An integrated Understanding of comparative physiological mechanisms
* Described the physiology of digestive and respiratory system .
* Understood the blood composition, types, groups and circulatory system.
* Described the physiology of excretory system and nervous system .
* Came to know the physiology of sense organs, muscles reproductive system and comparative study of endocrines organs and their secretion in non chordates and chordates.

COURSE OUTCOMES **PAPER - IV : ANIMAL BEHAVIOUR**

* Explained animal behaviour , Innate behavior, Stereotyped and acquired behaviour and response of animals to different instincts
* Understood the Interaction of biota abiota Patterns of communication (Chemical, visual, light, audio, Species specificity of songs, evolution of language with respect to primates), Social behaviour with reference to insects and primates;
* Came to know the Sexual behaviour: Courtship, sexual selection, mating patterns, parental care, migratory behaviour of fishes and birds; Territorial behaviour, Behavioural genetics
* Comprehended the various kinds of Animal adaptationsOrientation with special reference to insects, birds & bats; Instinct, Biological rhythms (Circadian & circannual rhythm ), Learning & memory (conditioning, habituation, insight learning, association learning reasoning cognitive skill)

# COURSE OUTCOMES: LAB

* Performed and understood the anatomy and physiology of animals (Arthropoda- Echinodermata) by dissection.
* Understood the anatomy and physiology of invertebrate animals by dissection.
* Described the structural study and mounting of organs.
* Came to knowing the rules of taxonomy and the principle of animal classification.
* Understood the diversity morphology, biological characters and taxonomical
* Understood the Taxis
* Came to know the comparative study of the differential leucocyte counts of fish, frog, bird . haemoglobin content of blood
* Came to know the effect of selected toxicant for selected organisms

**M.Sc. (FINAL) SEMESTER - III**

COURSE OUTCOMES **PAPER - I : CHORDATA**

* Understood the Origin of Chordates; Interrelationship of Ostracoderms, Placoderms; General organization and affinities of Holocephali, Crossopterygii and Dipnoi;
* Came to know the origin of tetrapoda; Neoteny in Amphibia; Origin and evolution of Reptiles, Birds, Mammals; Aerodynamics in birds; Adaptive radiation in Eutheria, Origin
* Described the Evolution of Man.

COURSE OUTCOMES **PAPER - II : ANIMAL DEVELOPMENT AND MORPHOGENESIS**

* Understood and mastered on the basic concepts of developmental biology.
* Understood how fertilization, cleavage and gastrulating occur.
* Understood the basic concepts of organogenesis.
* Understood about the basic concepts of growth, regeneration and ageing
* Described the test tube baby and placentation in mammals.

# COURSE OUTCOMES PAPER - III : BIOSTATISTICS, PRINCIPLES OF TAXONOMY & EVOLUTION

* Came to know the data collection, tabulation and presentation.
* Described the mean, median, mode and SD.
* Understood the Analysis of Variance.
* Described Student ‘t’ test and probability
* Understood the Correlation and Regression.
* Came to know Principles of Taxonomy **.**
* Understood that the four propositions underlying Darwin's theory of evolution through natural selection are:
* (1) more individuals are produced than can survive;
* (2) There is therefore, a struggle for existence
* (3) Individuals within a species show variation
* (4) Offspring tend to inherit their parental characters
* Explained adaptation, providing examples from several different fields of biology
* Explained how the molecular record provides evidence for evolution
* Understood the Human origin and evolution.

**PAPER - IV : (a) Fishery Biology- Morphology, Physiology and Development of Fishes**

* Learnt the general classification of fishes, economically important marine and freshwater fishes, migration and fishery products.
* Described recent concepts in fisheries management, endangered species management. Came to know the various aquaculture systems.
* Understood the type of hatchery, brood stock, larval production, feed management water quality and disease management in cultivable species, live feed production.
* Described the feed and disease management.

**PAPER - IV : (b) Entomology - Insect morphology, physiology & development**

* Imparts knowledge of beneficial and non-beneficial insects
* Knowledge of how they interact with their environment, other species and humans
* Classification of Insects Role of insects in spread of diseases
* Understood the morphology, physiology and development of insect

**COURSE OUTCOMES: LAB**

* Performed and understood the anatomy and physiology of animals by dissection.
* Understood the anatomy and physiology of invertebrate animals by dissection.
* Described the structural study and mounting of organs.
* Came to knowing the rules of taxonomy and the principle of animal classification.
* Understood the diversity morphology, biological characters and taxonomical
* General classification and survey of the structure or organization of the Chordate phyla.
* Understood the life history stages of frog and insects..
* Study of prepared slides of the embryology of frog, chick and mammals and mammalia placentation.
* Impart the knowledge of Microtomy.

**M.Sc. (FINAL) SEMESTER – IV**

**COURSE OUTCOME - PAPER - I : COMPARATIVE ANATOMY OF VERTEBRATES**

* Came to know comparative anatomy of the vertebrates: Digestive system; Respiratory system; Skeletal system. Circulatory system; Excretory system; Reproductive system.

**COURSE OUTCOME - PAPER - II : ECONOMIC ZOOLOGY & WILDLIFE**

* Impart the knowledge on economic zoology

Prawn culture; Fish Culture, Pearl culture; Apiculture, Sericulture, Poultry and Lac culture.

* Came to know about the Leather industry; Pharmaceuticals from animals, white revolution
* Comprehended the Endangered wild animal species; Wildlife conservation program and Wild life ecotourism management.

COURSE **OUTCOME- PAPER - III : (a) FISHERY BIOLOGY- TAXONOMY AND ECOLOGY OF PISCES**

* Comprehended the taxonomic study of fishes of Uttar Pradesh and Bihar.
* Came to know relationship between fishes and their abiotic and biotic environment
* Impart knowledge on Pollutants affecting fishery waters with special reference to oil spills, domestic pollutants, industrial water, Radio-active wastes, Sewage fed fisheries;
* Planktons in relation to fish production.

**COURSE OUTCOME- PAPER** PAPER - III : (b) **ENTOMOLOGY- ECOLOGY, EVOLUTION AND TAXONOMY**

* Understood the Insects and the abiotic Environment
* Came to know Insect Plant interactions
* Impart knowledge on Ancestry of insects, origin and evolution of insects, relationships between entognathous , ectognathous apterygotes and classification of insects; characters, classification of taxa.

**COURSE OUTCOME PAPER - IV : (a) FISHERY BIOLOGY- APPLIED ICHTHYOLOGY**

* Impart knowledge on Spawning, collection, hatcheries, rearing, stocking, transport and mortality of fish fry; Fertilization and management of Fishery pond
* Understood the Fish culture-Nutritional requirements of Carps Composite fish culture, cage culture and culture of exotic fishes, induced breeding; Common enemies and symptoms, etiology and treatment of diseases of food fishes; Fish-based industry and their byproducts.

**COURSE OUTCOME PAPER - IV : (b) ECONOMIC ENTOMOLOGY- BENEFICIAL AND HARMFUL INSECTS, INSECT PEST MANAGEMENT BENEFICIAL INSECTS**

* Understood the Biology of beneficial insects Harmful insects, Components of Insect Pest Management Pathogens, predators and parasitoids. Concept of integrated pest management (IPM) in agro-ecosystem.

**COURSE OUTCOMES: LAB**

**Fish Biology:**

* Performed and understood the anatomy and physiology of fish by dissection..
* Described the structural study and mounting of organs.
* Came to knowing the rules of taxonomy and the principle of fish classification.
* Performed and understood accessory respiratory organs and their blood supply in *Heteropneustis, Clarias, Channa* and Structural adaptations in fishes
* Came to know the preparation of a Skelton and an alizarine mount of fish.
* Understood the Osteology of *Wallago*.
* Described the systematics of freshwater fishes, with special reference to identification of local forms.

**COURSE OUTCOMES: LAB**

**Entomology:**

* Understood external features of grasshopper.
* Performed and understood the different systems of insects by dissections
* Came to know the permanent preparation of slide of different organs
* Comprehended the study of prepared slides of: T.S./L.S. of integument and the various regions of gut, ovary, testis and brain;
* Came to know collection of different kinds of larvae and pupae of insects. Permanent preparation of mouth parts, antennae, wings, legs, spiracles and external genitalia of insects from different groups. Study of life- histories of beneficial insects and their products.
* Comprehended dtudy of various groups of insecticides and equipments used for insecticides application