



Central University of Himachal Pradesh

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 PO BOX: 21, DHARAMSHALA, DISTRICT KANGRA – 176215, HIMACHAL
 PRADESH
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List of the courses to be offered in department of Animal Sciences during monsoon semester of academic session 2019-200

SN	COURSE CODE	COURSE NAME	Credits
M.Sc. Zoology semester - I			
1	ZOOL 410	Animal Taxonomy	4
2	ZOOL 411	Ecology and Environment	2
3	ZOOL 412	Cellular and Molecular Biology	4
4	ZOOL 413	Invertebrate Biology	2
5	ZOOL 414	Zoology lab I	2
6	ZOOL 415	Zoology lab II	2
Foundation Courses			
7	ZOOL 421	Sericulture	2
8	ZOOL 423	Aquaculture	2
		Total	20
M.Sc. Zoology semester - III			
1	ZOOL 525A	Entomology	2
2	ZOOL 526A	Animal behavior	2
3	ZOOL 527	Immunology and Biotechnology	2
4	ZOOL 528	Ichthyology	2
5	<i>ZOOL 571A</i>	<i>Pesticides hazards and Environment</i>	2
6	<i>ZOOL 572A</i>	<i>Insect control and IPM</i>	2
7	<i>ZOOL 573A</i>	<i>Agricultural Entomology</i>	2
8	<i>ZOOL 575</i>	<i>Entomology lab I</i>	2
9	ZOOL 561A	Fish taxonomy and Physiology	2
10	ZOOL 562A	Fish and Fisheries of India	2
11	ZOOL 563	Limnology of Lakes Streams and Ponds	2
12	ZOOL 566	Fisheries and limnology lab I	2
13	ZOOL 402	Evolutionary Biology and Biodiversity	4
Note: Subjects common for both specializations are highlights in bold font ; subjects in <i>italics</i> are for specialization entomology while subjects in normal font are for specialization fisheries.			
		Total	20



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SEMESTER- I

Course Code: ZOOL 410

Credit: 04

Course Name: Animal Taxonomy

Course Contents:

Unit - I Definition and basic concepts of Biosystematics, Taxonomy and Classification

1. History of taxonomy
2. Importance and applications of biosystematics in biology
3. Stages in taxonomy
4. Important taxonomic terms (i.e Allochronic & Synchronic species, Binomial nomenclature, Cladism, Sympatry, Category, Cline, Deme, Key, Phenon, Sibling species, Taxon, Variety etc.)

Unit - II Trends in Biosystematics-concepts of different conventional and newer aspects

1. Ecotaxonomy
2. Behavioural taxonomy
3. Cytotaxonomy
4. Biochemical taxonomy
5. Numerical taxonomy

Unit - III Concept of zoological classification

1. Theories of biological classification
2. Hierarchy of categories
3. Species Concepts: Biological, Evolutionary, Typological and Nominalistic
4. Polytypic & monotypic species, subspecies, super species & other infraspecific groups.

Unit - IV Taxonomic Procedures

1. Taxonomic collections/ collecting ways
2. Preservation of collected material & Curation
3. Methods of identification & Problems encountered in identification.
4. Taxonomic key

Unit – V Zoological Nomenclature

1. International code of Zoological Nomenclature (ICZN)
2. Operative principles and important rules of nomenclature
3. Criteria of publication, criteria of availability of names, principles of priority, homonymy, synonymy, type concept.

Recommended Books:

M.Kato.The Biology of Biodiversity. Springer.

E.O. Wilson, biodiversity. Academic Press, Washington.
G.G. Simpson, Principle of animal taxonomy. Oxford IBH Publishing company.
E. Mayer. Elements of Taxonomy. Oxford IBH Publishing company.
E.O. Wilson. The diversity of Life (The College edition W.W. Norton & Co.
B.K. Tikadar. Threatened Animal of India, ZSI publication Calcutta
V.C. Kapoor. Theory and Practice of Animal Taxonomy. Oxford & IBH Publishing Co.
J.C. Avise, Molecular Markers, Natural History and Evolution, Chapman & Hall, New York.



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SEMESTER- I

Course Code: ZOOL 411

Credit: 02

Course Name: Ecology and Environment

Course Contents:

UNIT-1 Concept of ecosystem

1. Physical environment; biotic and abiotic factors,
2. Ecosystem and its types,

UNIT-II Structure of ecosystem

1. Ecosystem structure, function productivity and energy flow
2. Habitat, ecological niche, fundamental and realized niche; resource partitioning; character displacement.
3. Ecological succession and its types

UNIT-III Population ecology

1. Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection);
2. Species Interactions and its types

UNIT-IV Biodiversity and its conservation

1. Biological diversity: concepts and levels, role of biodiversity in ecosystem functions and stability,
2. Categories of threat, Terrestrial biodiversity hot spots.
3. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-V Environmental Pollution

1. Air pollution
2. Water pollution
3. Soil pollution
4. Noise pollution
5. Ozone and climate change

Recommended Books:

Charls J. Krebs. 1972. Ecology: The Experimental Analysis of Distribution and Abundance
Philipson, J. 1966. Ecological Energetic, Edward Arnold Ltd. London.
Odum, E. P. 1970: Ecology, Amerind Publ. Co. New Delhi.
Kormondy, E. T. 1971. Concept of Ecology. Prentice Hall of India, New Delhi.
Ricklefs, R. E. 1973. Ecology. Thomas Nelson and Sons Ltd.
Colinbaux, P. A. 1985 Introduction to ecology. John Wiley & Sons.
Wiegert, R. G. 1976. Ecological Energetic Dowden, Hutchinson & Ross. Inc. Pennsylvania.
Scuthwick, C. H. 1976. Ecology and the quality of our environment. D. Van Nestrand
Fahey, J. J., and Knapp, A. K. 2007. Principles and Standards for measuring primary production.
Oxford Univ. Press. UK.
Grant, W. E. and Swanmack, T. M. 2008. Ecological Modeling. Blackwell Publ. Hou



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SEMESTER- I

Course Code: ZOOL 412

Credit: 04

Course Name: Cellular and Molecular Biology

Course contents:

UNIT- I: Cell structure and functions:

1. Introduction to Cell biology.
2. Basic properties of cells.
3. Structural organization and function of intracellular organelles: Nucleus, Mitochondria, Endoplasmic reticulum, Lysosomes, Peroxisomes.

UNIT- II: Cellular membrane and cytoskeleton:

1. An overview of membrane functions.
2. Membrane models.
3. Chemical composition of cell membrane.
4. Structure and functions of membrane proteins: Integral protein, peripheral membrane proteins and lipid-anchored membrane proteins.

UNIT- III Cell transport

1. Movement of substances across cell membranes: Diffusion, active transport, uniport, symport and antiport.
2. Structure and organization of Microtubules, Intermediate filaments and Microfilaments and their role in cell motility.

UNIT- IV: Fundamental Processes In Molecular Biology

1. DNA and its organization in cell; structure; A, B, and Z forms
2. Replication, Transcription, translation, damage and repair.
3. Regulation of gene expression in prokaryotes and eukaryotes

UNIT- V: Basic techniques

1. Microscopy application and types (TEM and SEM).
2. Centrifugation and Polymerase chain reaction (PCR).
3. Molecular Markers (RFLP, RAPD, SSR's and SNP's)
4. Blotting techniques.

Recommended Books:

Lewin, B. 2000. Genes VIII Oxford University, Press, New York

Alberts, B. Bray, D., Lewis, J. Raff, M., Roberts, K. and Watson, J.D. 1999, Molecular biology of the cell. Garland Publishing, Inc. New York.

Wolfe, S.L. 1993, Gruissem, W. and Jones, R.L. 2000, Biochemistry and molecular biology of plants, American society of plant physiologists, Maryland, USA

Frifelder, D. Molecular Biology. John and Bartlett Publishers, inc., Boston, USA



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SEMESTER- I

Course Code: ZOOL 413

Credit: 02

Course Name: Invertebrate Biology

Course contents:

UNIT- I : Organisation of Coelom

1. Acoelomates, Pseudocoelomate, Coelomates; Fate of blastopore: Protostoma and Deuterostoma.

Locomotion:

2. Flagella and ciliary movement in Protozoa.
3. Hydrostatic movement in Coelenterata, Annelida and Echinodermata.

UNIT- II : Nutrition and Digestion

1. Patterns of feeding and digestion in protozoa and Coelenterata.
2. Filter feeding in Polychaeta, Mollusca and Echinodermata.

UNIT-III: Respiration

1. Organs of respiration: Gills, Lungs and trachea. Respiratory pigments.
2. Mechanism of respiration.

UNIT- IV: Excretion:

1. Organs of excretion: coelom, coelomoducts, Nephridia and Malpighian tubules.
2. Excretion and osmoregulation.

UNIT- V: Nervous system:

1. Primitive nervous system: Coelenterata and Echinodermata.
2. Advanced nervous system: Annelida, Arthropoda (Crustacea and Insecta) and Mollusca.

Recommended Books:

Hyman, L.H. The invertebrates. Vol. I. Protozoa through Ctenophora, McGraw-Hill Co., New York.

Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson and Sons Ltd.

London.

Jagerstein, G. Evolution of Metazoan lifecycle, Academic Press, New York & London.

Hyman, I. H. The Invertebrates. Vol. 2 McGraw-Hill Co., New York.

Hyman, L. H. The Invertebrates Vol. 8, McGraw-Hill Co., New York & London.



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Practical Courses Sem. Ist

Course Code: ZOOL 414

Credit: 02

Course Name: Zoology Lab I

Course contents: Lab Course Based on ZOOL-410, ZOOL-411



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Course Code: ZOOL 415

Credit: 02

Course Name: Zoology Lab II

Course contents: Lab Course Based on ZOOL-412, ZOOL-413



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SEMESTER- I

Course Code: ZOOL 423

Credit: 02

Course Name: Aquaculture

Unit-I

Definition, History, Purpose, Scope and Status of Aquaculture, Kinds of Fisheries, Culture technology– freshwater (carps, Trout).

Unit-II

Abiotic (Physicochemical Factors in Freshwater Ecosystem): Physical characteristics of water: Temperature, thermal stratification, Light, Density, Water movement and thermal exchange.

Chemical characteristics of water: Hydrogen ion concentration (pH), Dissolved oxygen, Free carbon-dioxide, Total dissolved solids (T.D.S), Carbonates and Bicarbonates.

Unit-III

Integrated farming - fish-cum-live stock farming, paddy-cum-fish farming, Induced breeding, cryopreservation of gametes.

Unit-IV

Biochemical Composition, Preservation, Rigor mortis, feed types, manufacture and ingredients, Ailments and diseases of fishes, common fish pathogens, control of fish diseases.

Unit-V

Genetics approach to aquaculture – gynogenesis, androgenesis, triploidy, tetraploidy, hybridization, sex reversal and breeding, production of transgenic fish. Environmental impact of

aquaculture - aquacultural wastes and future developments in waste minimization, environmental consequences of hypernutrification.

Recommended Books:

1. Aquaculture Principles and Practices, Pillay, T. V. R., Blackwell Publishing, USA.
2. Aquaculture and Fisheries Biotechnology Genetic Approaches, Dunham, R. A., CABI Publishing, USA.
3. Joseph, M. Aquaculture in Asia. Manglore: Asian Fisheries Society, 1990.



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SEMESTER- I

Course Code: ZOOL 421

Credit: 02

Course Name: Sericulture

Course Content:

Unit-I

Silk and Silk Production: Origin and history of Sericulture, Different types of silk and silkworms in India; Rearing of *Bombyx mori* – Rearing racks and trays, disinfectants, rearing appliances, black boxing, Chawki rearing, bed cleaning, mountages, harvesting of cocoons.

Unit-II

Topography and climate for mulberry cultivation – latitude, temperature, humidity, rain fall, elevation and sun shine.

Silkworm diseases and Pest: Pebrine, Flacherie, Grasserie, Muscardine and Aspergillosis, and their management;

Unit-III

Beneficial and harmful insects: Rearing of silkworm, honey bee and lac insects. Silkworm rearing appliances and their uses. Disinfection of rearing house and appliances. Incubation and black boxing of silkworm eggs. Brushing of silkworm larvae. Feeding, bed cleaning and spacing in silkworm rearing. Moulting and care at moulting. Mounting and density of silkworm larvae for spinning.

Unit-IV

Processing of Silk: Physical and commercial characters of cocoons and silk. Cocoon sorting, stifling and cooking. Silk reeling devices – charaka, cottage basin, multi end, auto and semi-automatic reeling machines. Process of silk reeling, throwing, wet processing and weaving. Medicinal value of products and by-products of sericulture industry and their utilization.

Recommended Books:

1. Indian Journal of Sericulture - Cumulative Index by J. Justin Kumar.
2. Biological control of Insects pests in Mulberry sericulture by J.B. Narendra Kumar, Vinod Kumar and V. Sivaprasad.
3. Dandin, S.B.; Jayant Jayaswal and Giridhar, K. (Eds.) (2003) Handbook of Sericulture Technologies. CSB, Bangalore.
4. Dilip De Sarkar (1998) The Silkworm – Biology, Genetics and Breeding. Vikas Publishing House Pvt. Ltd., New Delhi
5. Journal of Sericulture and Technology - Published by NASSI, Bangalore.



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SEMESTER- III

Course Code: ZOOL 525A

Credit: 02

Course Name: Entomology

Course Content

UNIT- I General Introduction and characters of Class Insects, diversity and adaptive features of insect, Outline classification up to orders with examples. General Anatomical description of Insect body: Head: Structure of head, appendages and antennae Thorax: Generalized thoracic structure, Appendages of thorax Abdomen: Structure, Appendages , External female and Male genitalia

UNIT-II Modified Mouth parts :(Orthopteroid, Hemipteroid and Neuropteroid),Feeding mechanism Integument: Structure and functions of cuticle, Cuticular modifications, Moulting and Sclerotization Origin and Development of wings; variation of wing , mechanism of Flight

UNIT-III Brief study of Insect Physiology; Structure of alimentary canal and salivary glands, mechanism of digestion. Respiratory system: tracheal, aquatic and plastron respiratory mechanism. Circulatory system: organs, mechanism of circulation, haemolymph- cellular and chemical composition. Functions of haemocytes. Excretory system: organs and physiology of excretion.

UNIT-IV Structure of compound eye, Formation of image Chemical Communication in Insects: : Pheromones and allomones-chemistry and functions. Insect pollinators : Honey bees and butterfly Introduction of Predatory and Edible insects

UNIT-V Social Insects: Life cycle and Social organization of termites, honeybees and ants Sound production : Structure of the organs , Mechanism of sound production Significance Bioluminescence : Structure of organs Brief mechanism of light production Significance Metamorphosis – Types of Larva and pupae .



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SEMESTER- III

Course Code: ZOOL 526A

Credit: 02

Course Name: Animal Behaviour

Course Contents:

UNIT- I

Introduction - Definition, Branches of Ethology, history; significance of Animal behaviour, patterns of behaviour, objectives of behaviour.

UNIT- II

Reflexes- reflex action, types of reflexes, reflex arch, characteristics of reflexes and, Approaches and methods in study of behaviour.

Biological rhythms: Circadian and circannual rhythms, Orientation and Navigation, Migration in fishes and birds.

UNIT- III

Learning and memory: role of brain, conditioning, Habituation, Insight learning, Association learning and Reasoning. Role of Hormones and pheromones influencing behaviour of animals.

UNIT- IV

Ecological aspects of behaviour: Habitat selection, Homing & territoriality dispersal, Food selection, Optimal foraging theory, Anti- predator defences & host- parasite relation, aggression, social organization in honey bee, various type of communications.

UNIT- V

Reproductive behaviour- Mating system, Courtship, sexual selection, Social Behaviour: Aggregations- schooling in fishes, flocking in birds, herding in mammals, Altruism – reciprocal altruism, group selection, kin selection and inclusive fitness, cooperation, alarm call and Parental care.

Suggested Literature:

1. Mechanism of Animal Behaviour, Peter Marler and J. Hamilton; John Wiley & Sons, USA
2. Animal Behaviour, David McFarland, Pitman Publishing Limited, London, UK

- 3 Animal Behaviour, John Alcock, Sinauer Associate Inc., USA
- 4 Perspective on Animal Behaviour, Goodenough, McGuire and Wallace,
John Wiley & Sons, USA
- 5 Exploring Animal Behaviour, Paul W. Sherman & John Alcock, Sinauer
Associate Inc. ,Massachusetts, USA
- 6 An Introduction to Animal Behaviour, A. Manning and M.S Dawkins,
Cambridge University Press, UK



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SEMESTER- III

Course Code: ZOOL 527

Course Name: Immunology and Biotechnology

Course Instructor: Miss. Ekta Guleria

Credits: 2

Credits Equivalent: 2 Credits (One credit is equivalent to 10 hours of lectures / organized classroom activity / contact hours; 5 hours of laboratory work / practical / field work / Tutorial / teacher-led activity and 15 hours of other workload such as independent individual/ group work; obligatory/ optional work placement; literature survey/ library work; data collection/ field work; writing of papers/ projects/dissertation/thesis; seminars, etc.)

Attendance Requirement:

Students are expected to attend all lectures in order to be able to fully benefit from the course. A minimum of 75% attendance is a must failing which a student may not be permitted to appear in examination

Evaluation Criteria:

1. Mid Term Examination: 25%
2. End Term Examination: 50%
3. Continuous Internal Assessment: 25%
 - a) Presentation 10%
 - b) Class Participation 10%
 - c) Attendance 5%

Course Contents:

UNIT I

Cells and molecules involved in innate and adaptive immunity,
Antigens, antigenicity and immunogenicity.

UNIT II

B and T cell
structure and function of antibody molecules.
monoclonal antibodies,
antigen-antibody interactions

UNIT III

MHC molecules,
Antigen processing and presentation,
B and T cell receptors,
humoral and cell mediated immune responses,
Introduction to hypersensitivity and autoimmunity

UNIT IV

Introduction to Biotechnology
History, scope and significance of biotechnology.
Microbial culture as tool of biotechnology

UNIT V

Tools and techniques used in Biotech
Principles and applications of DNA recombinant technology,
PCR, Molecular markers (SSR, SNP, AFLP, RAPD, RFLP),
Construction of genomic/c DNA libraries and DNA sequencing

Suggested Reading:

Immunology by Janis Kuby

Immunology by E. Benjamini, R. Coico and G. Sunshine

Pratt, S.B. Molecular Biotechnology (second Edition), Blackwell Scientific Publications, Oxford, 1991.

Kumar H.D. A text book on Biotechnology, affiliated East West Press Pvt. Ltd., New Delhi, 1993.



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Course Code: ZOOL 528

Course Name: Ichthyology

Credits: 2

SEMESTER- III

UNIT- I

Introduction and History of Ichthyology, Classification and diagnostic characters (up to orders) of extant Cyclostomata, Chondrichthyes and Osteichthyes, External morphology, body form, appendages, pigmentation, Locomotion.

UNIT-II

Exo-Skeleton: Structure and development of Placoid and Non placoid scales, Food and feeding habits, Digestive system, Respiration: Structure and functions of gills; adaptations for air breathing; role of air bladder. Mechanism of gas exchange.

UNIT-III

Excretion and Osmoregulation: Types of kidneys, Mechanism of water and salt balance in fresh water, marine, estuarine fishes. Reproduction: Structure of gonads, gametogenic cycles; spawning, Parental care, Fish migration.

UNIT-IV

Nervous system and Sense organs: Organization of the central and peripheral nervous systems. Eye, lateral line organs and chemoreceptors, Electric Organ, Functions of the pituitary, thyroid.

UNIT-V

Applied Ichthyology: Integrated fish farming, Carp farming, Construction and Maintenance of Aquaria, Ornamental fishes, indigenous and exotic fishes, Economic importance of fish and fish products.



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SEMESTER- III

Course Code: ZOOL 572 A

Credit: 02

Course Name: Insect Control and IPM

Unit-I

History of insect pest control, basic principles and simple devices such as mechanical and cultural control.

Biological control of insect pests: principles, strategies, use of parasites, predators and pathogens.

Unit-II

Chemical insect control and Classification of insecticides: stomach poisons, contact poisons, botanicals, systemics, fumigants, common examples from each class and their mode of action, synergistic substances.

Resurgence and Physiology of insecticidal resistance.

Unit-III

Physical methods of pest control: use of radiations and chemosterilants, history and principle of sterile insect release method (SIRM), pheromones and hormones: use in insect pest management.

Unit-IV

Plant resistance to insects: types of resistance, mechanism of resistance-antibiosis, antixenosis, tolerance, factors mediating resistance, JH Mimics & MH-agonist.

Transgenic plants: history, *Bacillus thuringiensis* and its mode of action on insect, different sub species of *Bt*, development of *Bt* plant by recombinant DNA technology, resistance management of *Bt* crop, prospective and controversies of *Bt* crop.

Unit-V

Integrated Pest Management: history, principle, practices and different phases of pest control, Quarantine, genetic and biotechnological methods of control.



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SEMESTER- III

Course Code: ZOOL 573 A

Credit: 02

Course Name: Agricultural Entomology

Unit –I

Definition of pest, pest status, factors responsible for achieving the status of pest, General equilibrium position (GEP), Economic injury level (EIL), economic threshold level (ETL), action threshold, Damage boundary (DB), pest spectrum, pest complex, carrying capacity, causes of pest outbreak, secondary pest outbreak, pest surveillance and sampling.

Unit-II

Systematic position, host plants, nature of damage and outlines of the life cycle of the following pests of field crops, vegetables and fruits:

Paddy: *Scirpophaga incertulas* (yellow stem borer), *Hieroglyphus banian* (Rice grass hopper), *Dicladispa armigera* (Rice Hispa), *Leptocorisa varicornis* (Gundhi bug).

Wheat: *Macrosiphum miscanthi* (wheat aphid), *Tanymecus indicus* (Ghujhia weevil), *Pseudaletia separata* (Army worm), *Sesamia inferens* (Wheat stem borer).

Maize: *Chilo partellus* (maize stem borer), *Helicoverpa armigera* (corn worm), *Agrotis ipsilon* (cut worm).

Unit-III

Cotton: *Pectinophora gossypiella* (Pink bollworm), *Empoasca devastans* (cotton jassid), *Bemisia tabaci* (cotton white fly), *Dysdercus cingulatus* (Red cotton bug).

Sugarcane: *Pyrilla perpusilla* (Sugarcane leaf hopper), *Aleurolobus barodensis* (Sugarcane white fly), *Scirpophaga nivella* (Sugarcane top borer), *Chilo infuscatellus* (Sugarcane shoot borer).

Pluses: *Helicoverpa armigera* (Gram pod borer), *Maruca testulalis* (spotted pod borer), *Riptortus pedestris* (pod bug), *Chromatomyia horticola* (leaf miner).

Unit-IV

Vegetables: *Pieris brassicae* (Cabbage caterpillar), *Plutella xylostella* (Diamond-black moth), *Phthorimaea operculella* (potato tuber moth), *Epilachna vigintioctopunctata* (Hadda beetle).

Fruits: *Drosicha mangiferae* (Mango mealy bug), *Dacus dorsalis* (Mango fruit fly), *Quadraspidotus perniciosus* (san jose scale), *Erisoma lanigerum* (wooly apple aphid).

Unit -V

Pests of stored food products with particular reference to their habits, nature of damage caused by them and outlines of their life cycles :

Callosobruchus maculatus (Pulse beetle), *Sitophilus oryzae* (Rice weevil), *Rhizopertha dominica* (Lesser grain borer), *Trogoderma granarium* (Khapra beetle), *Tribolium castaneum* (Rust-red flour beetle).



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SEMESTER- III

Course Code: ZOOL 571 A

Credit: 02

Course Name: Pesticides Hazards and Environment

UNIT- I

Definition , classification , brief history, chemical nature of pesticide;
Structure of insecticide (organochlorides, organophosphates, carbamates, pyrethroids, insect growth regulator, botanical) and persistence in environment;
Routes and site of exposure : Inhalation, injection through food and intestine;
Problems of pesticide hazards and environmental pollution.

UNIT-II

Principles of toxicology : toxicants, toxicity , dose-response relationship;
Effects of pesticides : carcinogenic, mutagenic , teratogenic and other health hazards (ecological effect, immunotoxicity, synergistic and antagonistic action);

Evaluation of toxicity .

UNIT-III

Mechanism of action of DDT;
Bioaccumulation of xenobiotics and process of elimination of xenobiotics;
Antidotal procedure and precaution.

UNIT-IV

Insects and its environment : Inter relations with living and non living environment;
Fluctuation in insect population and insect dispersal: means and limiting factors.

UNIT-V

Extreme environment and insects : Desert insect, cave insect, high altitude insect, insects of terrestrial stream;
Entomophilous insects;
Insect mimicry.



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SEMESTER- III

Course Code: ZOOL 561 A

Credit: 02

Course Name: Fish Taxonomy and Physiology

UNIT I

Characters and classification:

Outline classification of fishes with special reference to distinctive features, geographical distribution classification and typical examples of the following sub- divisions: 1. Chondrichthyes 2. Actinopterygi 3. Crossopterygi 4. Dipnoi

Epidermis and Exoskeleton: Histology, Functions of Integument, Coloration, mechanism of colour change, Significance & uses of coloration, Types of scales & their uses.

Fins and their origin: Structure, median fins, caudal fin & its types; Paired fins & their origin

UNIT II

Cardio- Vascular System: Structure of heart in *Scoliodon* , Structure of heart in teleosts & its working, composition of blood.

Brain and Cranial Nerves: Fore brain, Mid Brain, Hind Brain, Spinal Cord and Nerves.

Respiratory organs: Structure and functions of gills, air breathing organs, swim bladder and weberian ossicles

UNIT III

Food, Feeding habits and Respiration:

Feeding habits of Teleosts, Carnivorous, Herbivorous and Omnivorous fishes, Alimentary canal and its diversity in fishes, Fish Nutrition and artificial food.

UNIT IV

Excretion and Osmoregulation:

Structure of Kidney, Histology of Kidney, Functions and Osmoregulation, Stenohaline and Euryhaline Fishes.

UNIT V

Reproduction, Development and Spawning:

Reproductive organs & their histology, Stages in maturation of an Oocyte, Fecundity, Survival and mortality in fishes, Sex dimorphism, mating and Parental care,

Books Recommended

1. Lynwood, S. Smith. Narendra Publ. House, Delhi. 2003. Introduction to the fish physiology.
2. Arvind Kumar and Pushaplata Dubey. Daya Publ. House, Delhi. 2006. Fish Management and Aquatic Environment
3. Lagler, Bardock, Miller & Possino, John Wiley & Sons, N.Y., London: 2012. Ichthyology, 2nd Ed.
4. Halver and Hardy. Acad. Press. 2002: Ash Nutrition . An Imprint



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SEMESTER- III

Course Code: ZOOL 562A

Credit: 02

Course Name: Fish and Fisheries of India

Unit I

Introduction, scope & status of fishery science. Pisciculture, Advantage of pisciculture, Freshwater water Culturable fishes, Economic importance of fishes.

Unit II

Definition, Purpose, Scope and Status of Aquaculture, Types of culture – Traditional, Extensive, Semi- Intensive, Intensive and Super- intensive culture, Criteria for selection of Sites, Culture Techniques: Carp culture, Trout Culture, Cage Culture.

Unit III

Fish Management and Marketing: Fishery management- Selection of cultivable species, Improvement of fish pond, Use of artificial food and correct stocking rate, Weeds of fish pond and their control, Fish enemies and their control,

Unit IV

Biochemical Composition, Preservation, Fish spoilage and Rigor mortis, Fish Processing, Principles and processes of: Drying, Salting, Freezing, Refrigeration.

Unit V

Induced breeding- Advantages of induced breeding, technique of induced breeding, factors affecting induced breeding. Migration in Fishes.

Books Recommended:

1. H.S. Bhamra and Kavita Juneja. 2001. An Introduction to Fishes
2. Arvind Kumar. 2004. Fishery Management
3. Heatranpf. 2002. handbook on Ingredients for Aquaculture feeds.
4. V.G. Jhingran. 1975. Fish and Fisheries of India.



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SEMESTER- III

Course Code: ZOOL 563

Credit: 02

Course Name: Limnology of Lakes, Streams and Ponds

Unit – I

Limnology, its history and scope

Origin and classification of water bodies – Lakes and ponds

Hydrological cycle

Ecology of ponds and lakes – Structure and dynamics

Unit – II

Abiotic (Physicochemical Factors in Freshwater Ecosystem): Physical characteristics of water: Temperature, thermal stratification, Light, Density, Water movement and thermal exchange.

Chemical characteristics of water: Hydrogen ion concentration (pH), Dissolved oxygen, Free carbon-dioxide, Total dissolved solids (T.D.S), Carbonates and Bicarbonates.

Turbidity: Causes and impact on aquatic organisms.

Unit – III

Inland Fisheries Resources: Riverine fisheries- Ganga river system, Brahmaputra river system, East coast river system.

Aquatic/Natorial adaptations of freshwater fauna.

Productivity of water bodies – Primary, secondary, tertiary - Factors affecting primary production.

Unit – IV

Plankton of freshwater biotopes – Phyto and Zooplankton, Plankton sampling: Methods of collection, preservation and identification.

Unit V

Aquatic pollution: Sources and kinds, effect of pollution on physico- chemical parameters of water, Effect of pollution on biota.

International problems and future: Acidification, Global warming, Biomagnification, Eutrophication.

Reference Books:

1. Welch, P.S. Limnology. McGrawHill, NY, 1952.
2. Hutchinson, G.E. A Treatise on Limnology, Vols. I & II. John Wiley & Sons, 1957.
3. Ruttner, F. Fundamentals of Limnology. Translated by D.G. Frey and F.E.Fry. University of Toronto Press, 1968.
4. Wetzel, R.G. Limnology. W.B. Saunders Co., 1975.
5. Reid, G.K. & R.D. wood. Ecology of inland waters and Estuaries. Van Nostrand Company, 1976.



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SEMESTER- III

Course Code: ZOOL 402

Credit: 04

Course Name: Evolutionary Biology and Biodiversity

Unit I:

Introduction to Evolutionary Biology: meaning and importance of evolution in biology. A brief history of life. The development of evolutionary theory Lamarckism, Darwinism, Natural selection, Neo-Darwinism and Mutation theory.

Unit II:

Concepts of neutral evolution, molecular divergence and molecular clocks, Molecular tools in phylogeny, classification and identification, Protein and nucleotide sequence analysis, Gene duplication, natural selection, genetic drift, mutation, recombination and gene flow. Modes of speciation, isolating mechanisms, speciation in time.

Unit III:

Macro and micro-evolution: definitions, mechanisms and importance. Evidences, patterns of evolution and extinctions over the geological period. Phylogeny: introduction and concepts of phylogeny. Phylogenetic trees, cladistics and phylogenetic reconstructions, hierarchy of species, transitional forms and molecular phylogeny.

Unit IV:

Biodiversity: Genetic, species and ecosystem diversity. Biogeographic classification of India. Endangered and Endemic species of India: Common plant and animal species. Threats to biodiversity- habitat loss, poaching and man-wildlife conflicts.

Unit V:

National Parks, Wild life Sanctuaries and Biosphere Reserves, Hotspots of Biodiversity. Conservation of Biodiversity, insitu and exsitu conservation, Keystone species, measurement of biodiversity.

Reference Books:

Population, Species and Evolution- Ernst Mayr

The theory of Evolution- J. Maynard Smith

Molecular Evolution and Origin of Life- Widney W. Fox and Klous Dose ,

Animal species and their evolution- A.J. Cain

Textbook for Environmental Studies- Erach Bharucha, UGC, New Delhi (2004), Environmental Biology- K.C. Agrawal,

Ecology & Environment- P.D.Sharma
Biodiversity- E.O. Wilson,
The Diversity of Life- E.O. Wilson.