



Central University of Himachal Pradesh

(Established under Central Universities Act 2009)

PO BOX: 21, DHARAMSHALA, DISTRICT KANGRA – 176215, HIMACHAL
PRADESH

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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 cellmediated immune responses,
Introduction to hypersensitivity and autoimmunity

UNIT IV

Introduction to Biotechnology
History, scope sand 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

Prtimrose, 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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SEMESTER- III

Course Code: ZOOL 528

Credit: 02

Course Name: Ichthyology

Course Content

UNIT- I Introduction and History of Ichthyology Classification and diagnostic characters (up to orders) of extant Cyclostomata, Chondrichthyes and Osteichthyes (9 major orders of fishes) ,Extinct fish group Origin, Evolution and Phylogeny of fishes External morphology, body form, appendages, pigmentation, Principles of morphometry, Locomotion

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

UNIT-III Excretion and Osmoregulation; Glomerular and aglomerular kidneys; Nitrogen(ammonia,urea, TMAO) excretions; Mechanism of water and salt balance in fresh water, marine, estuarine fishes. Role of skin and gills Reproduction: Structure of gonads, gametogenic cycles; spawning, Parental care Fish migration – types and regulation

UNIT-IV Brief introduction to Thermoregulation of Fishes Nervous system and Sense organs: Organization of the central and peripheral nervous systems. Eye, lateral line organs and chemoreceptors, Electric Organ Endocrine organs: Functions of the pituitary, thyroid, inter-renal and chromaffin tissues, ultimobranchial and corpuscles of Stannius

UNIT-V Buoyancy mechanisms: Role of fat and swim bladder Applied Ichthyology: Integrated fish farming, Carp farming, Snow trout 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, seasonal history, 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), *Mylocerus maculosus* (Cotton grey weevil).

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

Oilseed: *Lipaphis erysimi* (mustard aphid), *Spodoptra littura* (tobacco caterpillar), *Dasineura lini* (linseed gall midge)

Pulses: *Helicoverpa armigera* (Gram pod borer), *Maruca testulalis* (spotted pod borer), *Riptortus pedestris* (pod bug), *Mylabris phalerata* (blister beetle), *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), *Raphidopalpa foveicollis* (Red Pumpkin beetle), *Bactrocera cucurbitae* (fruit fly).

Fruits: *Drosicha mangiferae* (Mango mealy bug), *Dacus dorsalis* (Mango fruit fly), *Diaphorina citri* (Citrus psylla), *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), *Sitotroga cerealella* (Angoumois grain moth).

Locust- different species and phases, phase transition, periodicity, migration, biology



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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;
Entomophagous 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.