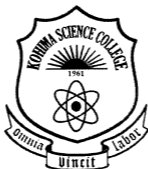


Kohima Science College, Jotsoma
(An Autonomous Government PG College)

Syllabus

for

Ph.D. Course Work
(ZOOLOGY)



Department of Zoology
Kohima Science College, Jotsoma
Kohima-797002

(2021)

Course Structure

(One Semester duration with a total of 16 Credits)

Course No	Course Title	Max. Marks	Credit
ZOO-01	Research Methodology	100	4
ZOO-02	Integrated Zoology	100	4
ZOO-03 (A-D)	Elective Course	100	4
ZOO-04	Literature review and Seminar	100	4
	Grand Total	400	16

Elective course offered:

ZOO-03 (A): Fish Biology

ZOO-03 (B): Limnology

ZOO-03 (C): Entomology

ZOO-03 (D): Biodiversity Conservation and Environmental issues

Research methodology

ZOO-01

Credit-4

Unit 1:

Research - meaning, objectives, types. Criteria of good research, research problems, research methods and methodology, data collection and processing.

Unit 2:

Responsible conduct of research, falsification and fabrication of data. Plagiarism- concept, software, legal aspects. Intellectual Property Rights (IPR) - patents, copyrights and related issues.

Unit 3:

Statistics and its application in Biology: Test of statistical significance-'t' test, Chi-square test; Analysis of variance; Simple correlation and regression; Use of statistical packages for ANOVA and multiple regression.

Unit 4:

Structures of research proposals, synopsis, dissertations, thesis, research paper writings. Scientific paper presentation in seminar and conference-oral and poster. Basic idea about the Impact factor of a journal.

Suggested readings:

1. Research Methodology-Methods and Techniques, New Age International, C. R. Kothari, 2nd Ed. (New Delhi), 2008.
2. Research Methodology: A step-by-step guide for beginners, SAGE Publications, Ranjit Kumar, 2005.
3. Data and computer communications by W. Stallings, Mc Millan Pub. Co. New York, 1976.
4. Zar, R. (1974). Biostatistic Analysis. Prentice Hall Inc.

Integrated Zoology

ZOO-02

Credit-4

UNIT 1:

Microscopy: Fluorescent and confocal electron microscopy; SEM and TEM; In-Situ Hybridisation techniques; FISH and MC FISH; Chromosome banding. Chromatography; Ion Exchange, Gel filtration, Affinity, HPLC. Spectroscopy; Electrophoresis and Isoelectric focusing.

UNIT 2:

DNA and RNA extraction; Preparation of cDNA; RT-PCR; Designing of primers; Real Time PCR; DNA cloning; Southern, Northern and Western Blots; DNA and protein sequencing, ELISA and RIA.

UNIT 3:

Bio-Computing; Biological Data Base (Protein & Nucleotide); BLAST and FASTA; Sequence comparison and alignment techniques; Bibliographic Resources; PubMed and PloS; Phylogenetic tree.

UNIT 4:

Indices of analysis of species richness, community similarities, species diversity, dominance and equitability. Guidelines for Bio-safety, functioning of Institutional Bio-safety committee, Institutional Animal ethics committee, and Institutional ethical committee , CPCSEA guidelines for animal experimentation.

Suggested readings:

1. Harris, R. (1991,Ed), Electron Microscopy in Biology : A practical Approach. IRL, Press, Oxford University Press, New York, Tokyo.
2. Maniatis, T. et al (1982). Molecular cloning: A laboratory Manual. Cold Spring, Harbour Laboratory.
3. Murad, H. and Atique, M.V.A. (1991). Biological Techniques in Electron microscopy, CBS Publication.
4. Nelson D.L and Cox M.M (2009). Principles of Biochemistry, 5th Edition.
5. Stiles et al (1991). Basic and clinical immunology, Prentice-hall International Inc.,
6. Awitser, R.L. and Garry, L.,F. (1999). Experimental Biochemistry, 3rd Edition, W.H. Freeman Company.
7. Letovsky, S.I. (1999). Bioinformatics. Kluwer Academic Publishers.
8. Lesk, A.M. (2002). Introduction to Bioinformatics, Oxford University Press.

Fish Biology

ZOO-03 (A)

Credit-4

UNIT 1:

Physiology of swimming; Role of muscles and fins; Capture of food and mechanism of digestion; Mechanism of gas exchange; transport of respiratory gases; Composition of swim bladder gas, its secretion and maintenance.

UNIT 2:

Role of hormones in aquaculture; Physiological regulation of the cardiovascular system; Fish haemoglobin; Glomerular and aglomerular kidneys; Excretion of nitrogenous wastes and ions balance; Osmoregulation in fishes.

UNIT 4:

Bioassay methods for evaluation of median lethal concentration; Use of natural toxin fisheries management; mode of action of xenobiotics and metal toxicity on physiological parameters in fresh water fish.

UNIT 5:

Collection and preservation of specimens; Morphometry, meristic counts and biometric index; Methods of measuring condition factor, food and feeding analysis of fish; fecundity and reproductive analysis, length-weight relationship of fish.

Suggested reading:

1. Ali, M.A (1980). Environmental Physiology of Fishes, Plenum press USA.
2. Evans, D.H (1998). The Physiology of Fishes. CRC Press, USA.
3. Hoar, W.S. and Randall, D.J.(1971-88). Fish Physiology. Academic Press, USA.
4. Kulkarni, G.K. nad Pandey, B.N.(2007). Fisheries and Fish Toxicology. APH Pub. Corp., India.
5. Reinecke, M., Zaccone, G. and Kapoor, B.G (2006). Fish Endocrinology. CRC. Press, USA.

Limnology
ZOO-03 (B)

Credit-4

UNIT 1:

Water- an environment for aquatic communities. Freshwater resources and global concerns-degradations of water quality. Conservation, management and recharge of freshwater aquifers. Freshwater Ecosystems-role and fate of major abiotic parameters.

UNIT 2:

Freshwater Biocoenosis-general composition, functional classification and role in aquatic biotopes; Different systems of classification of planktons; Methods in Freshwater Ecology-Nets, samples and traps; Qualitative and quantitative sampling of lentic, lotic and ground-water communities.

UNIT 3:

Trophic status-criteria (water quality and biotic) for assessment; Bio-indicator species and biotic indices; Role allochthonous and autochthonous matter. Nutrients of freshwaters-cycling of micro-and macro-nutrients, conservative vs dynamic ions. Role of aquatic communities in micro-nutrient cycles.

UNIT 4:

Bio-monitoring and bio-manipulation of freshwaters; Pollution in freshwaters-Eutrophication causes and consequences; Biomagnification and Bioaccumulation; Management and restoration of lakes, reservoirs and rivers. Waste waters: characteristics and treatment.

Suggested Readings:

1. Allan, J.A. (1995). Stream Ecology: Structure and function of running waters. Chapman and Hall.
2. Goldman, C.R. and Home, A.J. (1983). Limnology, McGraw-Hill International Book Company.
3. Jefferies, M. and Mills, D. (1992). Freshwater Ecology, CBS Publishers.
4. Kalf, J. (2002). Limnology, Prentice-Hall.
5. Moss, B. (1988). Ecology of Freshwaters, Blackwell Scientific Publications.
6. Payne, A.I. (1986). The Ecology of Tropical lakes and Rivers. John Wiley & Sons.
7. Wetzel, R.G. (1983). Limnology, Saunders College Publishing.
8. Wetzel, R.G. (2001). Limnology: Lakes and River Ecosystems. Academic Press.
9. Wetzel, R.G. and Likens, G.E. (2000). Limnological Analysis Springer-Verlag.

Entomology

ZOO-03 (C)

Credit-4

Unit 1:

Outline of classification; Insect and human life; Forensic Entomology. Insect Physiology; Neuroendocrine system; Metamorphosis; Thermoregulation; Hormonal regulation of growth and differentiation; Pheromones.

Unit 2:

Behavioral pattern in insect: locating food and initiating feeding, locating mates and copulation, oviposition, orientation, migration, protective behavior, concealing coloration, revealing coloration, & mimicry.

Unit 3:

Parasitism and predation in insects; Beneficial and detrimental aspect of insect; Types of pest control; Information required in dealing with a pest problem.

Unit 4:

Entomological techniques: Collection and preservation of insects-tools and techniques; identification (identification keys and other resources).

Suggested readings:

1. Imms, A.D (1964). The Text Book of Entomology. Methuen Co.London.
2. Romoser, W.S (1973). The Science of Entomology. McMillan Publ. Co. Inc., New York.
3. Wigglesworth, V.B. (1984) The Principles of Insect Physiology, 8thEdn. Chapman and Hall.
4. Gilbert L.I (2011) Insect Endocrinology, 1stEdn. Academic Press.
5. Chapman R.F. (2000) The Insects: Structure and Function, 4thEdn. Cambridge univ. Press.
6. Gullan P.J and Cranston P.S (1994) The insects, an outline of Entomology, Chapman & Hall.
7. Gilbert L.I (2011) Insect Endocrinology, 1stEdn. Academic Press.
8. Hermes, W.B. (1995) Medical and Veterinary Entomology. CAB International U.K.
9. Hill D.S (1994) Agricultural Entomology, Oregon Timber Press.
10. Ramakrisnan, T.V. (1984). Handbook of Economic Entomology of South India, International Books and Periodicals Service India.
11. Lamb, K.P (1974). Economic entomology in the tropics, London. Academic Press.
12. Fenimore, P.G. and Prakash, A (1992), Applied Entomology. Wiley Eastern Ltd.
13. Srivastava K.P (1993). Textbook of Applied Entomology, Vol. I & II, Kalyani Publishers, Ludhiana.

Biodiversity Conservation and Environmental issues

ZOO-03 (D)

Credit-4

UNIT 1:

Biosphere reserve-protected area network in NE and threat factors. Wildlife conservation and management – Keystone and umbrella species, endangered and endemic fauna of NE India. Restoration ecology – concept, principle, application. Bioremediation – Principles and applications.

UNIT 2:

Biodiversity – concept, biodiversity assessment and measurement of biodiversity, threat and uses of biodiversity. NE region as biodiversity hotspots. Environmental laws and regulations. Environmental ethics – causes of problems, religion, social culture, science and technology.

UNIT 3:

Air pollution – types, sources, interaction with plants, animals and humans. Air quality monitoring. Water pollution – sources, eutrophication, biomagnifications; Soil and noise pollution; Environmental priorities in India- effect and control strategies.

UNIT 4:

Climate change, risk to ozone layers, acid rain, emission of CO₂, Green house effect, desertification, loss of tropical forest, Impact of power generation – river valley and hydel power project; mining and oil exploration, thermal and nuclear power generation.

Suggested readings:

1. The ecology of Tropical lakes and rivers. John Wiley and sons.
2. Smith T.M and Smith R.L (2006) Elements of Ecology, 6thEdn. Pearson education Inc.
3. Odum .E.P. (1996) Fundamentals of Ecology 3rdEdn., W.B. Saunders Company.
4. Kormondy.E.J. (200). Concepts of Ecology 4thEdn. Prentice Hall of India Pvt. Ltd.
5. Smith .R.L (1974). Ecology and Field Biology 2ndedn..Harper & Row Publishers.
6. Krishnamurthy V.K (2003) Text Book of Biodiversity, Science Publisher, Chennai.
7. Rana S.V.S (2005) Essentials of Ecology and animal Science, Prentice Hall of India Pvt. Ltd.
8. Botkin D. And Keller E. (2014) Environment science, John Willey and Sons. Inc., New York.
9. Handbook on convention on Biodiversity (2006). UNEP, Viva Books Pvt. Ltd. Kolkata.
10. Hill D., Fasham M., Graham T., Shewary M. and Saw P. (2005) Handbook of Biodiversity Methods: survey, Evaluation and monitoring, Cambridge University Press.

Literature review and Seminar

ZOO-04

Credit-4

The student should select a research topic and read the literature and present one talk in a seminar. This has to be done in consultancy with the Ph.D. supervisor

Examination: Viva based on presentation/seminar