SCHOOL OF SCIENCES
DHANAMANJURI UNIVERSITY, MANIPUR

SYLLABUS FOR Pre-Ph.D. COURSE WORK
(Zoology)

2022

COURSE STRUCTURE

Paper code	Paper Title	Marks	Credits
CORE-001	Research Methodology and Computer Applications	100	4
CORE-002	Research & Publication Ethics and Zoology General Elective Paper	100	4
ZOOL-003	Entomology	100	4
ZOOL-004	Fishery	100	4
ZOOL-005	Animal Physiology & Endocrinology	100	4
ZOOL-006	Genetics & Molecular Biology	100	4
ZOOL-007	Parasitology	100	4
ZOOL-008	Ecology	100	4
Total		**300**	**12**

CORE-001
[Research Methodology and Computer Applications]

FULL MARKS: 100

TOTAL CREDITS: 4

Unit 1:

1. Meaning of Research; Objectives of Research; Types of Research; Significance of Research; Challenges and Problems during Research.

2. Basic principles of Research designs; Selection of research topics; Hypothesis of Research; Design of synopsis writing.

Unit 2:

1. Preparation of review literature; Methods of collecting primary and secondary data; Importance and methods of editing and data validation; Writing of results and discussions; Preparation of references/bibliography.

2. Basic concepts of thesis writing and report generation; Preparation and writing of research and review papers.

Unit 3:

1. Principles and applications of Spectrophotometry, Electrophoresis, Polymerase Chain Reaction (PCR) , Laminar flow, Ultracentrifuge, Autoclave, Light and Electron microscopy, Chromatography (HPLC, GC-MS), Handling of instruments and precautions.

2. Definition and types of computer; RAM, ROM, CPU, I/O devices; Number system: binary, octal & hexadecimal, base conversion; Logic gates: AND, OR, NOT; Date structure: array, stack (push, pap), queque (insert, delete), linked list; Operating system: definition and types; Use of software; MS office: power point, word, excel, Access; Computer hazards (viruses, hacking, etc.).

Unit 4:

1. Probability theories: conditional probability, poisson distribution, binomial distribution & properties of normal distributions; Hypothesis Tests: one sample test, two sample test, chi-square test, t-test; Standard deviation.

2. ANOVA; Correlation-Regression Analysis: Analysis of variance, Completely Randomized design, Randomized Complete Block design, Latin square design; Discriminate analysis: Cluster analysis, Factor analysis, Conjoint analysis.

CORE-002

[Research & Publication Ethics and Zoology General Elective]

FULL MARKS: 100

TOTAL CREDITS: 4

RESEARCH & PUBLICATION ETHICS **2 Credits**

Unit 1:

1. Philosophy and Ethics: Introduction to philosophy: definition, nature and scope, concept, branches; Ethics: definition, moral philosophy, nature of moral judgements and reactions.

2. Scientific Conduct: Ethics with respect to science and research; Intellectual honesty and research integrity; Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP); Redundant publications: duplicate and overlapping publications, salami slicing; Selective reporting and misrepresentation of data.

3. Publication Ethics: definition, introduction and importance; Best practices/ standards setting initiatives and guidelines: COPE, WAME, etc.; Conflicts of interest; Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types; Violation of publication ethics, authorship and contributorship; Identification of publication misconduct, complaints and appeals; Predatory publishers and journals.

Unit 2:

1. Open Access Publishing: Open access publications and initiatives; SHERPA/RoMEO online resource to check publisher copyright &self-archiving policies; Software tool to identify predatory publications developed by SPPU; Journal finder, journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

2. Group Discussions: Subject specific ethical issues, FFP, authorship; Conflicts of interest; Complaints and appeals: examples and fraud from India and abroad

3. Software tools: Use of plagiarism software like Turnitin, Urkund and other open-source software tools.

4. Databases and Research Metrics: Indexing databases; Citation databases: Web of Science, Scopus, etc.; Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score; Metrics: h-index, g index, i10 index, altmetrics

ZOOLOGY GENERAL ELECTIVE **2 Credits**

Unit 3: Microbiology and Immunology

1. Scope and History of Microbiology
2. Characterization, Classification, and Identification of microorganisms.
3. Immunity to bacteria, fungi, protozoa, and worms.
4. Generation, activation and differentiation of lymphocytes.

Unit 4: Molecular Biology and Biochemistry

1. Principles of cell signalling; Signalling through G-protein-coupled Receptors; Concepts on cell death.
2. Cancer: Cause, classification, Pathophysiology, and Prevention.
3. Biochemistry of Aging: Wear and Tear theories of Aging, Aging as a preprogrammed process.
4. Damages to DNA, proteins and lipids by free radicals, and the diseases associated with radical damage.

ZOOL-003

[Special Elective Paper: Entomology]

FULL MARKS: 100

TOTAL CREDITS: 4

Unit 1:

1. Modern approaches to Insect Taxonomy: Cuticular chemicals, Isozyme pattern, DNA, RNA, Cytochrome oxidase, and mt-DNA based techniques in insect systematics.
2. Recent trends in insect cytogenetics research.

Unit 2:

1. Ecological methods of sampling, and analysis of aquatic, terrestrial and air born insects, and construction of life table statistics.
2. Modern methods of pest management; Transgenic crops, biopesticides, protease and trypsin inhibitors.

Unit 3:

1. Sensillory system of insects and interactions of insect pheromones and plant semio-chemicals.
2. Role of allelochemicals in host plant mediations.

Unit 4:

1. Insect cell culture and cell lines; Insect immunology and toxicology.
2. Ecology and evolution of insect baculoviruses.

ZOOL-004

[Special Elective Paper: Fishery]

FULL MARKS: 100

TOTAL CREDITS: 4

Unit 1:

1. Integrative Fish Taxonomy and Systematics; Biogeography and Distribution of freshwater fish species.
2. Drainage Basin Evolution in South and South-east Asia; e-DNA, meta barcoding and genomic sequence analysis studies in fisheries.

Unit 2:

1. Modern Aquaculture Techniques: General Principle, Monitoring and Environmental Aspect, Intensive, Semi-Intensive and Extensive.
2. Re-circulatory Aquaculture technologies: Management and Monitoring; Aquaponics: Integrated fish farming system.

Unit 3:

1. Nutritional requirements of fish, fish feed formulation, assessment of nutritional quality of fish feeds: *in vitro* and *in vivo*; Nutracenticals.

Unit 4:

1. Advances in processing technology, Fishery product development, Quality assessment of fishery products.
2. Fermented fish products of North-east India, Nutritional and microbial quality of fermented fish products.
3. Fish marketing and economy.

ZOOL-005
[Special Elective Paper: Animal Physiology & Endocrinology]

FULL MARKS: 100
TOTAL CREDITS: 4

Unit 1: General Physiology

1. Hepatobiliary system: Synthesis and secretion of bile, composition of bile, regulation and release of bile flow, functions of bile.
2. Lymphatic system: Lymph channels, formation and circulation of lymph, role of lymphatic system in controlling interstitial fluid protein concentration, volume and pressure.
3. Role of Renin-Angiotensin system in control of arterial blood pressure.

Unit 2: Endocrinology

1. Chemical nature, synthesis, storage, release, transport and degradation of hormones.
2. Hormonal regulation of carbohydrate, protein, lipid, water, and electrolyte metabolism.
3. Metabolic and life style disorders.

Unit 3: Behavioural Physiology and Chronobiology

1. Approaches and methods in study of behaviour; proximate and ultimate causation; altruism and evolution-group selection, kin selection, reciprocal altruism.
2. Human circadian rhythm and its cellular and molecular mechanisms of control.

Unit 4: Reproductive Physiology

1. Hormonal control of menstrual cycle; mechanism of folliculogenesis and ovulation.
2. Chemical, mechanical and immunological method of controlling fertility.
3. Reproduction and senescence.

ZOOL-006
[Special Elective Paper: Genetics & Molecular Biology]

FULL MARKS: 100
TOTAL CREDITS: 4

Unit 1:

1. Metaphase chromosome preparation; Karyotyping; Chromosome banding techniques: G-banding, C-banding, Q-banding and R-banding.
2. Fluorescence *in situ* hybridization (FISH); Cytogenetic endpoints/assays *in vivo* and *in vitro* chromosome aberration assay.
3. Micronucleus assay and sperm head abnormality assay, Comet assay, Microarray, Cytogenetic assays in early cancer detection.

Unit 2:

1. Genetic changes in progenitor cells, p53 mutations, oncogenes, tumour suppression genes, basic features, types and detection of mutation.
2. Ames test: separation of mutants and non-mutants.

Unit 3:

1. Genome editing using CRISPR-CAS 9 and Zinc Finger nuclease technology, benefits and drawbacks.
2. KASP (Kompetitive Allele Specific PCR) assay for SNP detection.
3. Next generation sequencing; Understanding of NGS platforms including advantages and limitations.

Unit 4:

1. Mechanism of cell killing by radiation, Cell survival curve, effect of radiation on synchronously dividing cell culture.
2. Dose: rate effect, dose-response relationship.
3. Factors affecting radiation effect, radioprotectors, radiosensitizers, acute effects of total-body irradiation, analysis of radiation, induced mutations, different types of radiation dosimetric methods, radiation-carcinogenesis.

ZOOL-007
[Special Elective Paper: Parasitology]
FULL MARKS: 100
TOTAL CREDITS: 4

Unit 1:

1. Introduction to pathogenic protozoans of man; Free-living pathogenic *Amoebae* of man in relation to PAM (Primary Amoebic-Meningo-encephalitis) and GAE (Granulomatous Amoebic encephalitis).

Unit 2:

1. Compromised hosts and parasitic infections, Opportunistic parasites, Nosocomial parasitic infections.

Unit 3:

1. Microscopic anatomy of Miracidium, Redia, Sporocyst, and Cercaria with special reference to mechanism of penetration to the host.
2. Identification of microfilaria, microfilarial periodicity.

Unit 4:

1. Nematodes as vectors of plant diseases, with special reference to plant viruses.
2. Economic importance of phytonematodes and root knot parasites in agriculture.
3. Control or management methods of plant parasitic nematodes.

ZOOL-008

[Special Elective Paper: Ecology]

FULL MARKS: 100

TOTAL CREDITS: 4

Unit 1: Ecosystem

1. Community structure, vertical structure on land and aquatic ecosystems.
2. Biological structure of a community: species dominance, species diversity, species abundance; Ecosystem services and sustainability, Basic concepts of system ecology.
3. Primary and Secondary production in ecosystems; Ecosystem productivity; Methods of measurement of primary productivity, Recent trends in patterns of biomass distribution, Productivity and energy allocation in different ecosystems of the world (grassland, forest and aquatic ecosystems).

Unit 2: Biodiversity

1. Concept, assessment, inventory and uses of biodiversity; Types of measurement of biodiversity.
2. Human impact on biodiversity; Values of biodiversity: instrumental, economic and intrinsic values; Threats to biodiversity.
3. Biodiversity and ecosystem function; Conservation of biodiversity; Biodiversity Acts and Rules; International and National efforts for conserving Biodiversity.

Unit 3: Environmental Pollution and Climate change

1. Sources, causes, effects and remedial measures of different types of Environmental pollution.
2. Causes and effects of Global warming and Climate change; Carbon stock and rate of carbon sequestration; Carbon trading and Carbon tax.
3. Bioremediation and its implications; Environmental Impact Assessment (EIA): origin, development, process and impact identification methods.

Unit 4: Sustainable Development and Ecological Sustainability

1. Definitions and Concepts, Causes of unsustainability's threats to sustainable development.
2. International programme on sustainable development and strategies; Ecological restoration and recent developments: terms and definitions, strategies of restoration, restoration plan and rehabilitative measures, restoration of terrestrial and aquatic ecosystems.