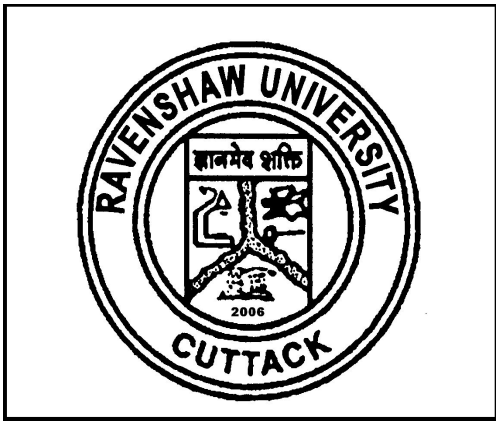
COURSES OF STUDIES FOR

M.PHIL. ZOOLOGY

Semester pattern

(Effective from the session 2010-2011)



RAVENSHAW UNIVERSITY

CUTTACK -753003

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RAVENSHAW UNIVERSITY
M.Phil. ZOOLOGY
Course outline: 2010-2011

Paper No.	Course title	Marks
	SEMESTER-I	
ZO-I	General paper (Research Methodology and Trends in Zoology)	100
ZO-II	Intensive paper (Students to choose any one) A. Environmental Science B. Molecular Biology and Genetic Engineering	100
ZO-III	Practical based on respective Intensive paper (Students to choose any one) A. Environmental Science B. Molecular Biology and Genetic Engineering	100
	SEMESTER-II	
ZO-IV	Dissertation	200
ZO-V	Viva-voce	100

Paper- I
Paper No ZO-I
RESEARCH METHODOLOGY AND TRENDS IN ZOOLOGY

UNIT - I

1. Principle of operation and Instrumentation of Light, Fluorescence and Electron Microscopy.
2. Principles of electrochemical techniques: Electrochemical cells and reactions, potentiometry and voltametry
3. The pH electrode, ion-selective and gas-sensing electrodes, Clark type oxygen electrode.

UNIT – II

1. Equipments and materials for animal cell culture: Design and layout of culture room, Basic equipments used in cell culture, Sterilization and aseptic techniques. Culture media: General considerations in media design, Natural media, Synthetic media, Nutritional compounds of media, Role of serum in cell culture.
2. Primary culture and its maintenance**:** Various techniques of tissue disaggregation, Biology and characterization of the cultured cells
3. Scaling up of animal cell culture; measuring parameters of growth; Cell cloning; Cell transformation; Measurement of viability and cytotoxicity.

UNIT – III

1. Ultraviolet-visible absorption spectroscopy: Principle, Instrumentation and application
2. Fluorescence spectrophotometry: Principle, Instrumentation and application
3. Radioisotope techniques: Nature of radioactivity, isotopes in biochemistry, measurement of radioactivity (carbon dating, Geiger-Muller counting and liquid scintillation counting), autoradiography.

UNIT - IV

1. Centrifugation techniques**:** Basic principles of sedimentation, Types of centrifuges, Types of rotors, Methods in preparatory ultracentrifugation (differential and density gradient centrifugation).
2. Electrophoretic techniques**:** General principles, support media, electrophoresis of proteins (SDS-PAGE, native gels, gradient gels, isoelectric focusing gels and two dimensional gels), electrophoresis of nucleic acids (Agarose, pulse-field and sequencing gels).
3. Chromatographic techniques**:** Principles of chromatography (Adsorption and Partition chromatography), Planar chromatography (Paper and Thin-layer chromatography), Column chromatography (Gas chromatography, Gel exclusion/permeation chromatography, Ion-exchange chromatography, Affinity chromatography, HPLC).

UNIT – V

1. Statistics: Meaning, Definition, functions and limitations. Measures of central tendency (mean, median & mode), Measures of dispersion, Coefficient of variation.
2. Elementary idea about probability, Normal, Poison & Binomial distribution
3. Test of significance: Student's t test, Chi square test, Analysis of variance, Simple correlations and regression. Use of MS Excel for elementary statistical analysis.

Reference Books

1. Physical Biochemistry by David Freifelder
2. Practical Biochemistry by Keith Wilson and John Walker
3. Modern Experimental Biochemistry by Rodney Boyer.
4. Practical biochemistry by David Plumer

5. Analytical Biochemistry by D. Holme and H. Peck
6. Basic Biostatistics by GBN Chainy, G Mishra & PK Mohanty
7. Statistics in biology & physiology by Debajyoti Das
8. Statistical methods from research work by RA Fisher
9. Culture of animal cells by R.I. Freshney
10. Tissue Culture – Methods and Applications by Paul F. Kruse Jr. and M. K. PattersonJr.
11. Cell Culture Lab Fax by Butler and Dawson.
12. Cell and Tissue culture: Laboratory procedures by Doyle and Griffiths
13. Block, R. I. Durram E. K. and Eweig, G. 1956. A manual of paper chromatography and electrophoresis, Academic Press, New York.
14. Chayan J & Butcher R. G. 1973. Practical histochemistry, Willey Interscience Publication,London.
15. Haftman. E, 1967. Chromatography. Reinhold publishing corporation, New York.
16. Jones R. M. 1966. Basic microscopic techniques, University of Chicago Press, Chicago.
17. Sharma and Sharma 1999. Cytogenetic Techniques.

Paper-II
Intensive paper

Paper No. ZO-II (A) Environmental Science

Unit I Methodology-Marine Biology and Fresh water Biology

Methods of sampling Benthos-Strategies & Sampling

Design & Collection of bottom sediments for Hydrobiological studies employing dredges, cores and grabs. Analytical techniques for seawater and freshwater sediment analysis.

Community analysis-Statistical methods for segregating assemblages. Estimation of diversity patterns & their Significance.

Acquaintance with literature on benthic studies in Indian coastal waters.

Ecosystem based research-Mangrove creeks, Coastal lagoons, shelf waters & slope.

Strategies for marine biological investigations-shipboard requirements

Impact & assessment of anthropogenic effects on marine seabed life.

Water chemistry and ecological aspects of Water Pollution. Type, sources and consequences of Water Pollution. Waste water and its treatment, origins and characteristics of liquid industrial effluents discharged in the water body, chemical and bacteriological sampling and analysis.

UNIT-II Environmental Impact Analysis

Human activities and impacts: local, regional and global; short-term and long-term impacts on Environment.

Origin and development of EIA, National environmental policy and statutory requirements of EIA; objectives of EIA.

Methodology of EIA; scoping, categorization and evaluation criteria; prediction and assessment of impact, interactions between environmental components and impacts.

Alternate strategies and mitigation measures, environmental monitoring and audit.

Case Studies: Urban development, thermal and atomic energy projects, mining projects.

Unit III: Toxicology

Toxicity tests and concepts of LD_{50} and LC_{50}. Sources and types of toxicants and their health hazards, Dose-effect and Dose response relationship; Frequency response and cumulative response, Dispersion and circulating mechanisms of pollutant, degradable and non-degradable toxic substances in food chain, Bio-absorption of heavy metals. Bio-transformation and Bio-accumulation, Biomagnifications.

Study of heavy metals: (1) Properties and occurrence (2) Production (3) Industrial uses (4) Metabolism and Physiology (5) Toxicology (6) Prophylaxis (7) Therapy.

Aluminium, antimony arsenic, barium, beryllium, bismuth, cadmium, chromium, cobalt, copper, lead, magnesium, manganese, mercury, molybdenum, nickel, platinum, rubidium, silver, tin and zinc.

Unit IV: Biotechnological pollution control methods and Remote Sensing Applications

Biosubstitution, Bioremediation: in situ and ex situ techniques-biosparging,bioventing, injection recovery, land farming, soil banking, and soil slurry reactor techniques.

Phytoremediation: phytoextraction, rhizofiltration, phytostabilisation, phytodegradation and phytovolatilisation. Phytomining.Macrophyte based wastewater treatment systems, Algal effluent treatment systems and their limitations.

Basics of Remote Sensing and Application

Groundwater Exploration: Mapping of landforms, tithology, structure, landuse. Soil, drainage and integration with available geophysical, hydrological and hydrogeological data.

UNIT-V Soil Pollution and Solid Waste Management

Physico-chemical, mineralogical and biological properties of soil. Soil organic matter. Micro-organisms of soil. Decomposition of organic matter in soil. Pollution and residual toxicity from the application of insecticides, fungicides, weedicides and synthetic fertilizers.

Sources and nature of solid wastes; their characterisation and classification.Methods of dispersal and management of solid wastes.Recycling of waste materials.Interactions between industrial effluents and soils; soil contamination with radionuclides.

References

1. Odum, E.P . Fundamentals of Ecology.W.B. Saunders Company,Philadelphia.
2. Pieulou, E.C. An Introduction to Mathematical Ecology. Wiley, Interscience,New York.
3. Barnes R.S.K & Hughes R.N. An Introduction to Marine Ecology.
4. Environmental Biotechnology theory and application, G. M. Evan, J. C. Furlong, JohnWiley & Sons, Ltd,-/2503
5. Environmental Biotechnology Principles and Applications, B. E. Rittmann, P. L. McCarty, Mc Craw-Hill International Editions/Singapore, 2001.
6. Environmental Biotechnology, B. C. Bhattacharrya, and R. Banerjee, Oxford UniversityPress.
7. Fundamentals of Ecology- M.C Dash
8. Marine ecology-concepts and applications- Martin R.Speight and P.A.Handerson.
9. Environmental biotechnology, S.N. Jogdand
10. Environmental biotechnology, T. Srinivas
11. Fundamental of Toxicology- Adhikari and Upadhaya
12. Toxicology- Wallace Hayes
13. Toxicology- V.C Kapoor
14. Environmental Science- Santra and Santra
15. Environmental chemistry - A.K. Dey

16. Biotechnology- HD Kumar
17. Wastewater Engineering- Treatment, Disposal and Reuse by Metcalf and Eddy

Paper No. ZO-II (B) Molecular Biology and Genetic Engineering

UNIT-I

1. Scope of Genetic engineering, Milestones in genetic engineering
2. **Molecular tools**: **Enzymes** (Nucleases, Restriction endonucleases, Phosphomonoesterase, Alkaline phosphatase, Polynucleotide kinase, DNA ligase, DNA polymerases, Reverse transcriptase, terminal deoxynucleotidyl transferase, Poly A polymerase), **Hosts** (E. coli, yeast, animal cells and Plant cells) and **Vectors** (Plasmids, Bacteriophages, Cosmids, Phagemids and artificial chromosomes)
3. **Means**: **Inserts** (Genomic DNA, synthetic DNA, DNA from RNA or cDNA, PCR products, Nucleic acid purification, yield analysis, labeling nucleic acid probes (isotopic and non-isotopic labeling) **Infection and transfection, Screening** (Phenotypic, antibiotic and through hybridization).
4. Nucleic acid sequencing (Maxum-Gilbert sequencing, Sanger's dideoxy sequencing, pyrosequencing, automated DNA sequencing)
5. Techniques in genetic engineering: Polymerase Chain Reaction (PCR; General protocol, Primer designing, fidelity of thermostable DNA polymerases, Types of PCR), Southern, Northen & Western blotting

UNIT-II

1. **Mapping of genome**: Genetic and physical maps, physical mapping (restriction mapping, fluorescence in situ hybridization, sequence tagged site mapping), map based cloning, choice of mapping population, simple sequence repeat loci, southern and fluorescence in situ hybridization for genome analysis, molecular markers in genome analysis (RFLP, RAPD, AFLP, SSLPs, STRs and SNPs)
2. Molecular markers linked to disease resistant genes, application of molecular markers in forensics, disease prognosis, genetic counseling, pedigree analysis, animal trafficking and poaching, germplasm maintenance, taxonomy and biodiversity**.**
3. **Genome sequencing:** Construction of libraries (genomic and cDNA), strategies for sequencing genomes, packaging, transections and recovery of clones, application of sequence information for identification of defective genes. Expression cloning, Jumping or hopping libraries, Southwestern and Farwestern cloning.
4. **DNA transfection**: Physical methods (microinjection, electroporation, biolistics, somatic cell fusion, Gene transfer by pronuclear icroinjection), Chemical method (liposomes), Virus mediated transfection.

UNIT-III

1. **Expression Strategies for Heterologous genes**: *Saccharomyces cerevisiae* expression systems (*S. cerevisiae* vectors, intracellular cellular production of heterologous proteins, secretion of heterologous proteins by *S. cerevisiae*), *Pichia pastoris* and other yeast expression systems, Baculovirus-insect cell expression systems, mammalian cell expression systems.

2. **Mapping and quantifying transcripts:** Northern blot, S_1 mapping, RNase protection assay, Primer extension, Run-off Transcription and G-less cassette transcription, Nuclear Run-on transcription and Reporter gene assays.

UNIT-IV

1. **DNA-protein interactions:** EMSA, DNase foot printing, Methyl interference assay, CHIP
2. Yeast two hybrid system
3. Phage display.

UNIT-V

1. Role of gene tagging in gene analysis, T-DNA and transposon tagging, identification and isolation of gene through T-DNA transposon.
2. Gene therapy
3. Knockout and transgenic technologies
4. Gene silencing (ribozyme, antisense and RNA_i technologies).

References

1. Molecular Clonning: A laboratory manual by J. Sambrook and E.F. Fritsch.
2. Genome by T.A. Brown.
3. DNA Science. A First Course in Recombinant Technology by Mickloss and Freyer
4. Molecular Biotechnology by S.B. Primrose
5. Principles of gene manipulation by Primrose, Twyman and Old
6. Molecular Biotechnology by Glick and Pasternack.
7. Molecular Biology by Weaver
8. Genes and Genomes by Singer and Berg
9. Selected papers from Scientific journals
10. Technical literature from Stratagene, Promega, Novagen, New England Biolab etc.

Paper-III
Practical (Based on intensive paper)

Paper No. ZO-III (A) Environmental Science

1. Estimation of temperature, pH, and turbidity of water samples.
2. Estimation of Dissolved oxygen (DO), Biochemical oxygen demand (BOD), acidity, alkalinity, hardness, iron and COD of water samples.
3. Estimation of chloride, nitrate, sulphate and phosphate in water samples.
4. Determination of LD_{50}/LC_{50} value of a toxicant.
5. Determination of heavy metal toxicity by germination and seedling growth tests.
6. Sampling for soil micro flora in soil and water through dilution plate method.
7. Study of planktons.

8. Determination of organic matter /texture of soil.

References for Practical

1. Water Quality, Sampling and Analysis, S. A. Abbasi, DPH, New Delhi, 1998.
2. Methods in Environmental Analysis: Water Soil and Air, P. K. Gupta, Agrobios, Jodhpur,2000.
3. Fundamentals of Environmental Sampling and Analysis, Z. Chunlong, Wiley Interscience,Germany 2007.
4. Standard Methods for the Examination of Water and Wastewater, American Public Health
5. Analysis of Sea water –Grasshoff

Paper No. ZO-III (B) Molecular Biology and Genetic Engineering

1. Biochemical separation of protein, lipid and nucleic acids from animal tissue and their estimation.
2. Isolation of genomic DNA
3. Isolation of RNA
4. Determining the purity of isolated nucleic acids by UV-spectrophotometry
5. Agarose gel electrophoresis of DNA & RNA
6. Separation of proteins by SDS-PAGE
7. Determination of molecular weight of proteins by SDS-PAGE
8. Calculation of similarity index from SDS-PAGE protein patterns or RAPD data of closely related organisms

References for Practical

1. Practical biochemistry by David Plumer
2. Molecular Clonning: A laboratory manual by J. Sambrook and E.F. Fritsch.