BHARATHIDASAN UNIVERSITY
TIRUCHIRAPPALLI - 620 024.

M. Phil. ZOOLOGY(FT / PT) PROGRAMME
(For the candidates admitted from the academic year 2007-2008 onwards)

Semester I

	Title of the Course	Marks			Credits
		IA	UE	Total	
Course -I	Research Methodology	25	75	100	4
Course - II	Bio-Instrumentation and Biological Techniques	25	75	100	4
Course- III	Molecular Zoology	25	75	100	4

Semester II

Course – IV	Elective (Any one) 1 Insect Pest Management 2 Aquaculture and Water Quality Management 3 Environmental Toxicology 4 Hydrobiology	25	75	100	4
	Dissertation and Viva-Voce Viva Voce 50 marks Dissertation 150 marks	200 (150+50)			8

QUESTION PAPER PATTERN (Course I – IV)

Part - A: Two questions from each unit (without choice). Each question carries 2 marks. (10 x 2 = 20)

Part – B: One "EITHER OR" questions from each unit Each question carries 5 marks (5 x5 = 25).

Part – C: One question from each unit. Each question carries 10 marks. The candidate has to answer three questions out of the five questions (3 x 10 = 30)

M.Phil. Zoology
Course - I : Research Methodology

Unit : I

Research: selection of problem-stages in the execution of research: from choosing a topic to publication - MS preparation - report writing - Thesis format - proof reading - format of journals - sources of information: journals, reviews, books, monographs etc-bibliography.

Unit : II

Journals: standard of research journals-paid and refereed journals-impact factor-citation index- choice of journals for publication. Information retrieval: access to archives and databases, search engines: google, pubmed etc - national informatics center network services. online data base library

Unit : III

Measures of dispersion: Universe and population-delimiting population-sampling methods: random sampling, stratified random sampling- variables : qualitative and quantitative - continuous and discontinuous - Scaling method - Mean-standard deviation-standard error-coefficient of variation: elucidation with model sums.

Unit : IV

Comparison of means: chi square and student t test: Model sums. ANOVA: partitioning of variation-F test - Model sums on one way ANOVA with interpretation of data-introduction to MANOVA-Statistical tables and their use - Brief introduction to pie chart and bar diagrams. Use and advantages of statistical software like COSTAT and STATISTICA.

Unit : V

Bivariate relationships: Uses of Correlation and regression. Correlation and regression coefficients - components of regression equation - ANOVA in regression. Confidence intervals of regression lines. Fitting simple regression lines: model sums, calculation of equation and fitting of regression line, estimated and calculated Y - confidence intervals, significance tests - fixing significance levels - interpretation of results

REFERENCES

Davis, G.B and C.A. Parker 1997. Writing the doctoral dissertation. Barrons Educational series, 2nd edition. Pp 160.ISBN:0812098005.

Duncary,P.2003. Authoring a Ph.D. thesis: how to plan, draft, wirite and finish a doctoral dissertation. Palgrave Macmillan, Pp256. ISBN 1403905843.

Saxena, S. 2001. MS office, Vikas Publishing house Pvt. ltd. New Delhi 110014

Snedecor, G.W. and W.G. Cochran, 1978. Statistical methods. Oxford and IBH publishing Co Pvt. ltd.

Sokal, R.R. and F.J. Rohlf, 1981. Biometry. W.H. Freeman, New york.

Zar, J.H. 1996. Biostatistical analysis. Prentice Hall, Upper Saddle River, New Jersey, USA.

Course II : Bioinstrumentation and Biological Techniques

Unit I

pH meter – Principles of pH – Electrodes and components – pH scale, acids, bases and buffers.
Centrifuges – Centrifugation principles – Basic principles and laws of sedimentation.
Preparative and analytical ultracentrifuges – Differential and density gradient centrifugation – Analysis of sub-cellular fractions.

Unit II

Chromatography – Theory and practice – Column chromatography – Types of adsorption and partition chromatography – Paper chromatography – Ion-exchange chromatography – Affinity chromatography. Principles and applications of GCMS, LPLC and HPLC.

Unit III

Electrophoretic principles – Apparatus – Factors affecting electrophoresis – Types of electrophoretic techniques – Zonal and disc electrophoresis – Principles and application of PAGE, agarose gel electrophoresis, immunoelectrophoresis.

Unit IV

Photometry – Basic laws of light absorption – X-ray diffraction – Calorimeter, UV and Visible light spectrophotometer – Spectrofluorimeter – Flame photometer and Flame emmision spectrophotometer – Atomic absorbtion spectrophotometer – Infra-red spectrophotometer – Basic principles, instrumentation and application of mass spectrometry, NMR and Tandem mass spectroscopy.

Unit V

Geiger-Muller Counter – Basis of radioactivity and components – Liquid scintillation counter – Theory of liquid scintillation, components and correction of quenching and luminescence.
Microscopy – Principles and application of light, dark field, phase contrast, fluorescent, polarization – Scanning and Transmission electron microscope – Confocal microscopy – Inverted microscope – Immunofluorescent techniques, probes and live cell imaging – Image capturing, processing and analysis.

References:

1. Willard, HH., Merritt, LL., Dean, JA., Settle Jr. Fa. 1986. *Instrumental Methods of Analysis*. CBS Publishers. New Delhi.

2. Wilson, K., and Walker, J. 1984. *Principles and Techniques of Practical Biochemistry*. Cambridge University Press. Cambridge.

3. Plummer, Dt. 1971. *An Introduction to Practical Biochemistry*. McGrawHill. London.

4. Skoog, DA., Weat, DM., Holler, FJ. 1988. *Fundamentals of Analytical Chemistry*. 5th Edition, Saunders College Publishing, Philadelphia.

5. Campbell, ID., Dwek, RA. 1984. *Biological Spectroscopy*. The Benjamin/Cummings Publising Company, California.

6. Rawlis, DJ. 1992. *Light Microscopy*. Bios Scientific Publishers. Oxford.

7. Bradbury, S., Evenett, PJ. 1996. *Contrast Techniques in Light Microscopy*. Bios Scientific Publishers. Oxford.

8. Jayaraman, J. 1981. *Laboratory Mannual in Biochemistry* – Wiley Eastern Ltd., New Delhi.

9. Skoog, A., and West, M. 1980. *Principles of Instrumental Analysis*. W.B Saunders Co., Philadelphia

Course III : Molecular Zoology

Unit –I

Molecular basis of heredity (review), Molecular basis of mutation and recombination- transposons- Organization of genome; definition and description of promoters, enhancers, silencers, transcription factors, RNA transcription and gene expression - regulation of gene expression – Translation- Post-translational processing and protein structure – Splicing - Alternative splicing.

Unit – II

Introduction to transgenic animals – transfection - Selectable markers – Microinjection- Embryonic stem cells - Reporter in transgenes - Different approaches in transgenesis – Application of transgenesis in disease diagnosis and gene therapy - Transgenesis and growth performance in livestock - molecular pharming.

Unit - III

The role of maternal stored mRNA in the development process- Role of the cytoplasmic determinants and morphogens - Activation of the zygotic genome - Molecular basis of cellular induction and cell differentiation - Role of homeobox genes in development - Sex determination – Molecular basis of pattern formation.

Unit -IV

Cell cycle (review)- Cell culture lab and requirements - primary cell culture - Nutritional requirements for animal cell culture- techniques for mass culture of animal cell lines- Application of animal cell culture for production of vaccines, growth hormones – interferons - cytokines and therapeutic proteins- stem cells and their applications – Cell culture as expression system.

Unit – V

Electrophoresis (Agarose; PAGE) - Methods of DNA profiling – RAPD - RFLP – Satellite DNA – VNTR – SNP. Principles and Techniques involved in southern Hybridization - western blot – Northern blot – PCR – DNA sequencing – Proteomics.

Reference:

1. Principles of Gene Manipulation and Genomics (2006) by S. B. Primrose, R. M. Twyman and R.W. Old, Blackwell Scientific Publications.
2. Gene Cloning and DNA Analysis. An Introduction (2001) by T. A. Brown, Blackwell Scientific Publications.
3. Recombinant DNA (1992) by J.D. Watson, M. Gilman, J. Witowski and Mark Zoller, Scientific American Books.

4. From Genes to Clones: Introduction to gene technology (1987). Winnacker, E.L.
5. Molecular cloning: A Laboratory Manual (2001). Sambrook, J., Russell, D.W., Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York.
6. Comprehensive Biotechnology (Vol.1-4) (2004) by Moo-Young, Robinson Howell.
7. Proteins and Proteomics (2003). Richard J. Simpson, I.K. International Publication Pvt. Ltd. New Delhi.
8. Protein Analysis and Purification (2004), by Ian M. Rosenberg, Springer International Ltd. Boston.
9. Culture of Animal Cells (2003), by Ian Freshney, Wiley-Liss Publication, New Jersy, USA.
10. Proteomics (2004), by Timothy D.Veenstra and John. R. Yates, Wiley-Liss Publication, New Jersy, USA.
11. Culture of Cells for Tissue Engineering (2006), by Gordana Vunjak-Novakovic Ian Freshney, Wiley-Liss Publication, New Jersy, USA.
12. Molecular Biology of the Gene (5^{th} Edition) by Watson, J.D., Baker, T.A., Bell, S.P., Alexander Gann, Michael Levine and Richard Pearson Education Inc.
13. Molecular Biology of the Cell (4^{th} Edition) , by Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter, Garland Science Publication.
14. Genes VIII, by Benjamin Lewin, Oxford University Press.

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ELECTIVE COURSE 1.1: INSECT PEST MANAGEMENT

Unit I

Major pests: Insect biology, behaviour and physiology- Damage caused and control methods of pests of paddy, sugar cane, cotton, red gram, ground nut, mango, coconut, brinjal, tomato, banana and stored products- Household insect pests: Mosquito, cockroach, housefly and termites- Mechanisms of pest resistance.

Unit II

Preventive pests control methods: Natural control: Climatic factors, physical factors, natural enemies. Physical control, Mechanical control and Cultural control.

Unit III

Chemical control methods: Chemical control: Origin, discovery and development of insecticides, classification, mode of action, formulation, appliances and application, precautions, pesticide poisoning and antidotes- Organic compound insecticides: Carbaryl and synthetic pyrethroids, mode of action.

Unit IV

Biological control methods: Botanical pesticides, insecticidal properties, mode of action- Parasitic and Predatory insects, spiders, vertebrates- Microbial pest control, viruses, bacteria, fungi, Protozoa, nematodes- Fumigants, antifeedants, sex attractants, repellants, chemosterilants, insect growth regulators- Integrated pest management.

Unit V

Biotechnological approach to insect pest control: Transgenic plants, the approaches, positive and negative consequences- Emerging approaches to pest control- Genetic improvement of biological control agents.

Reference Books

1. Vasantharaj David, B. 2002. Elements *of Economic Entomology*. Popular Book Depot., Chennai.

2. Lalit Kumar Jha, 1994. Applied *Agricultural Entomology*. New Central Book Agency (P) Ltd., Culcuta.

3. Prem Mohan Nigam and Ashok Kumar, 1990.*A Text Book of Agricultural Entomology*, Emkay Publications, Delhi.

4. Nayar, K.K., T.N. Ananthakrishnan, and B.V. David. 1986. *General and Applied Entomology*, Tata McGraw Hill Publications, New Delhi.

ELECTIVE COURSE I.2: AQUACULTURE AND WATER QUALITY MANAGEMENT

Unit I

Farm preparation and practices: Site selection- Farm design- Pond construction- Pond preparation for stocking- Earthening- Watering- Manuring- Accessories for farm- Seed selection criteria- Hatchery technology and nursery management- Seed and stocking .

Unit II

Culture of prawn and fish: Prawn culture- Fish culture- Ornamental fish culture- Monoculture, monosex culture and polyculture- Integrated fish farming- Culture of live feed organisms- Bioencapsulation- Assessment of growth and production- Harvest- Transport- Eeconomics.

Unit III

Management of Feed: Types of feed- Need for supplementation- Supplementary feed- Ration and time of feeding- Feed monitoring- Growth monitoring- Methods of feed preservation and problems- Utilization of fish as products and by products- Fish and prawn and marketing.

Unit IV

Disease Management: Diseases caused by bacteria, viruses, protozoans and fungi- Deficiency diseases- Parasitic diseases- Prophylactic methods- Control of diseases by physical, mechanical, chemical, biological and antibiotic methods- Management of competitors and predators.

Unit V

Water quality management:, Turbidity- Salinity- pH- Temperature- Dissolved oxygen- CO_2- BOD- Ammonia and other factores- Water exchanges- Aeration (Aerators, Blowers, Injectors)- Micronutrients and Plankton- Effluent management.

Reference Books

1. T.V.R. Pillay, 1994. *Aquaculture - Principles and Practices*. Fishing News Books, Blackwell, London.

2. V.G. Jhingran, V.G. 1998. *Fish and Fisheries of India*. Hindustan Publishing Corporation, New Delhi.

3. Baradach, J.E., J.H. Ryther, J.H. and W.O. Mc Larney, W.O., 1972. *Aquaculture. The farming and Husbandry of Freshwater and Marine Organisms*. Wiley Interscience, New York.

ELECTIVE COURSE I.3: ENVIRONMENTAL TOXICOLOGY

Unit I

Survey of environmental toxicants: Classification of toxicants- Toxic Residues- Mode of action of toxicants- Toxicity- Combined action of toxicants in aquatic and terrestrial environment.

Unit II

Metabolism of toxic substances: Uptake- Excretion- Chemical localization of toxic substances in animals and its consequences- Hepatic metabolism and detoxification- Synergistic and antagonistic effects- Variations in metabolism between animals and comparative toxicology.

Unit III

Water pollution: Heavy metals- Pesticides- Sewage and domestic wastes- Industrial effluents- Petroleum and related compounds- Radio nuclides- Thermal pollution.

Unit IV

Toxic bioassay: Evaluation of toxicity- Bioassays- Static boassay methods- Hazards and risk assessment- Criteria for safety evaluation- Upper and lower confidence limits- Cumulative toxicity- Evaluation of acute, chronic and sublethal toxicity in animals- Bioindicators.

Unit V

Assessment of environmental risk: Factors affecting toxicity of chemicals- Toxicants in the soil- Toxicants in natural waters- Effects of temperature and weather condition- Distribution of toxicants in the biosphere- Monitoring of environmental toxicants.

Reference Books

1. Casarett, L.J. and Doull, J. l975. *Toxicology: The Basic Science of Poisons*. Mac Millan, New York.

2. De Bruin, A. 1977. *Biochemical Toxicology of Environmental Agents*. Elsevier, Amsterdam.

3. Duffus, J.H. 1980. *Environmental Toxicology*. Edward Arnold, London.

4. Paget, G.E. (Ed.). 1970. *Methods in Toxicology*. Blackwell, Oxford, London.

5. Valkovic, V. I975. *Trace Element Analysis*. Taylor and Francis. London.

6. M. A. Subramanian, 2004. *Toxicology: Principles and Methods*. MJP Publishers, Chennai.

ELECTIVE COURSE I.4: HYDROBIOLOGY

Unit-I

Water: Distribution, sources, properties, composition- Water as universal solvent- Hydrological cycle – Hydrological reserves- Water as the cradle of life

Unit II

Properties of water: Physical, chemical and biological properties- Temperature, light, turbidity, Salinity, pH, dissolved oxygen, carbon dioxide and other factors of marine, estuarine and fresh water- Effect on the distribution of aquatic organisms- Adaptations in organisms.

Unit-III

Water quality: Drinking water- ROS system- Standards- Bacterial contamination - Indicator organisms.

Unit IV

Pollution: Properties of pollutants- Concentration- Long distance movement- Biological concentration and discrimination- Sources of pollution: Domestic, industrial, agricultural, oil spills, radioactive wastes, heavy metal- Preventive/control measures.

Unit-V

Instrumentation: Water quality analysis- pH meter, colorimeter, atomic absorption spectrophotometry, flameless atomic absorption spectrophotometry, gas chromatography, HPLC, ion selective electrodes- Working principles and applications.

Reference Books

1. Schmitz, R.J. 1996. *Introduction to Water Pollution Biology*. Asian Books Pvt. Ltd., New Delhi.

2. Kothandaraman, H. and Geetha Swaminathan, 2002. *Principles of Environmental Chemistry.* B.I. Publishers Pvt. Ltd., Chennai -600 002.

3. Ghosh, G.K. 1992. *Environmental Pollution.* Ashish Publishing House, New Delhi.