

# **FACULTY OF LIFE SCIENCES**

## **Syllabus**

**For**

### **Pre Ph.D. Course in Zoology** (Credit Based Evaluation & Grading System)

**Examinations: 2019–20**



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**Guru Nanak Dev University**  
**Amritsar**

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Pre Ph.D. Course in Zoology  
(Credit Based Evaluation & Grading System)

**Scheme of Courses**

**Programme Code : ZOZ**

Course no.	C/E/I	Course Title	L	T	P	Total Credits
LSL 901	C	Research Methodology	3	1	0	4
ZOL 941	C	Best Ecological Practices and Biodiversity Conservation	3	0	0	3
ZOL 942		Principles of Toxicology	3	0	0	3
ZOL 943		Genetics: A molecular approach	3	0	0	3
ZOS 931	C	Seminar	0	0	1	1
	I	Interdisciplinary course	3	0	0	3
						17

- Course of Research Methodology is compulsory.
- Interdisciplinary course can be subscribed from any other department, depending upon the choice of research topic/interest of the student.
- Seminar shall be given in the department with guidance of the supervisor.

### **LSL-901 - Research Methodology**

**Time: 3 Hrs.**

**Credits 3-1-0**

**Max. Marks : 100**

**Mid Semester Marks : 20**

**End Semester Marks : 80**

**Mid Semester Examination: 20% weightage**

**End Semester Examination: 80% weightage**

#### **Instructions for the Paper Setters:**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Note: The course will be numerical oriented to train the students for the analysis of research data. Use of calculators will be allowed in the examination.**

#### **SECTION-A**

1. **Descriptive statistics:** Statistical expressions, central tendency, dispersion of data (arithmetic and geometric), moments, skewness, kurtosis, sample size estimation.
2. **Probability:** Concept of probability, conditional probability, distributions: Normal, Poisson, binomial, 't',  $\chi^2$ , F-distributions.

#### **SECTION-B**

3. **Testing of hypothesis:** Central limit theorem, null hypothesis and alternative hypotheses, Z-test, Student's t-test,  $\chi^2$ -square, F-test, sample size, confidence intervals. odds ratio, index numbers, Probit analysis.
4. **Correlation and regression analysis:** Linear correlation and regression, exponential regression, logarithmic regression, reciprocal regression, Michael-Menten's regression, logistic regression, Gompertz regression, monomolecular regression.

#### **SECTION-C**

5. **Multiple correlation and regression:** MLR with 2 and 3 independent variables, quadratic and cubic polynomial regressions, Beta regression, sine curve, multiple correlation, partial correlation, path analysis, time series analysis.
6. **Experimental designs:** Experimental designs, central composite designs with 2 and 3 factors.

#### **SECTION-D**

7. **Analysis of Variance:** Assessing normality, one way and 2-way ANOVA, Tukey's multiple comparison test, HSD.
8. **Multivariate analysis:** Cluster analysis and dendrogram, principal component analysis, factor analysis, artificial neural networks.
9. **Non-parametric tests:** Wilcoxon's, Mann-Whitney's tests, Spearman's rank correlation, Kendall's Tau.
10. **Basic Greek and Latin words:** The students will learn Greek alphabet and more than 100 basic roots and words used in science.

**Note: The students will be asked to submit an assignment of computer softwares designed by them on the basis of the Research methodology syllabus.**

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**References:**

1. Bailey, N.T.J. (1995). Statistical Methods in Biology. Cambridge University Press, Cambridge.
2. Kothari, C.R. (2004). Research Methodology: Methods and Techniques, New Age International Publishers, New Delhi.

**ZOL-941: Best Ecological Practices and Biodiversity Conservation.**

**Time: 3 Hrs.**

**Credit:3-0-0**

**Max. Marks : 100**

**Mid Semester Marks : 20**

**End Semester Marks : 80**

**Mid Semester Examination: 20% weightage**

**End Semester Examination: 80% weightage**

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**Section-A**

**Integrated Pest Management**

Types of Pests

Factors influencing pest population

Pest Management strategies.

- Cultural control
- Mechanical control
- Host plant resistance
- Biological control
- Legislative control
- Chemical control

Semiochemicals and other approaches

Integrated pest management

**Section-B**

**Biodiversity conservation with respect to Aquatic ecosystems.**

**River Rehabilitation.**

Rehabilitation of Floodplains . Protection and Restoration of Fish Movements.

Wetlands conservation.

Wetland losses, Wetland degradation and Invasive species , Global climate change, Wetland Restoration.

Biodiversity of Inland waters.

Water Quality Alteration and Distribution of biodiversity.

**Section-C**

**Kinds of wastes and disposal practices of wastes.**

Classification of wastes

Physico-chemical properties of waste affecting earthworm.

Effect of earthworm on physico-chemical properties of waste.

Soil organisms and their interaction with earthworms.

Effect of human activities on earthworm.

### Section-D

#### **Municipal Solid Waste, Generation, Collection, Separation and Transportation**

Introduction to various methods used for disposal of wastes:-

Recycling, Thermal conversion technologies (Incineration, pyrolysis, Gasification)

Biological Transformations

Chemical Transformations

#### **Books Recommended :**

1. Atwal, A. S. and Dhaliwal, G. S. (1997). Agricultural pests of South Asia and their management. Kalyani Publishers, New Delhi.
2. Dent, D. (1991 ), Insect Pest Management, CAB International Wallingford, U.K.
3. Dhaliwal, G. S. and Arora, R.(1996) Principles of insect management. Globe offset press, New Delhi.
4. Fenmare, P.G. and Parkash, A. (1992), Applied Entomology. Newage International Limited Pb.
5. Hill, D. S. (1993), Agricultural insect pests of the Tropics and their Control. 2<sup>nd</sup> Ed. , Cambridge University Press, Cambridge, New York.
6. Mariau, D. (1999) Integrated pest management of tropical perennial crops. Science Publisher Inc. U.S.A.
7. Mayer, K. K., Anantha Krishnan, T. N. and David , B.V. (1976 ), General and Applied Entomology, Tata McGraw.
8. Pedigo, L. R. (2002). Entomology and pest management. 4<sup>th</sup> edition, Pearson education, Inc. , New Jersey.
9. Pradhan, S. (1991) Agricultural entomology and pest control ICAR, New Delhi.
10. Van Ender, H. F. (1989) Pest control, second edition Cambridge University Press U. K.
11. Venugopal, Rao, N., Uma Maheswar, T., Rajendraprasad, P., Govardhan Naidu, V. and Savithri, P. (2003) Integrated Insect pest management Dr. Updesh Purohit for Agrobios, Jodhpur.
12. Dasgupta, M.K(1998). Phytonematology. Naya Prokash, Calcutta, India.
13. Swarup, G. Dasgupta, D.R. and gill, J.S (1995). Nematode Pest Management: An appraisal of eco-friendly approaches. Nematological Society of India, New Delhi.
14. Ravichandra, N.G.(2008). Plant Nematology. I.K. International Publishing House Pvt. Ltd, Bangalore.
15. Cowx, I. G. and Welcomme, R. L. (1998). Rehabilitation of Rivers for Fish. Food & Agriculture Organization of the United Nation & Fishing News Books, U.K.
16. Vander Valk, A. G. (2006). The Biology of Freshwater Wetlands. Oxford University Press, New York.
17. Wetzel, R. G. (2001) Limnology. Lake and River Ecosystems Academic Press, U.S.A.
18. Edwards, C.A., Lofty, J.R. (1977) Biology of Earthworms, Chapman and Hall Landon.
19. Bhatnagar, R. K. and Palta, P.K. (2003). Earthworm, Kalyani Publishers, India.
20. Brady, N.C., and Weil, R.R (2002), The nature and properties of soil Pearson Education Pvt Ltd., Indian Branch, New Delhi.
21. Twetia, G (2007), Earthworm Ecology, Discovey publishing House, India.

### **ZOL-942: Principles of Toxicology**

**Time: 3 Hrs.**

**Credit: 3-0-0**

**Max. Marks : 100**

**Mid Semester Marks : 20**

**End Semester Marks : 80**

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**End Semester Examination: 80% weightage**

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#### **Section-A**

1. History of Toxicology.
2. Measuring Toxicity and Assessing risk.
3. Toxicokinetics: Absorption, distribution and elimination of Toxins.

#### **Section-B**

1. Toxicopanomics: Application of Genomics, Proteomics and Metabolomics in Toxicology
2. Biotransformation of Toxins: Phase I and Phase II reactions.
3. Carcinogenesis

#### **Section-C**

1. Reproductive toxicology and Teratology.
2. Effects of Toxins on: Respiratory, Cardiovascular, nervous, hepatic, renal and Immune system.

#### **Section-D**

1. Ecological Toxicology: Effects of Toxins at population, community and ecosystem level.
2. Applications of Toxicology: Forensic Toxicology, Pharmacology, Environmental Toxicology.

#### **Books Recommended :**

1. Hayes, A. W. (2007). Principle and Methods of Toxicology, CRC Press NY.
2. Newman, M.C. and Clements, W.H. (2008). Ecotoxicology –A Comprehensive Treatment, CRC Press, NY.
3. Stine, K. E. and Brown, T. M. (2006). Principles of Toxicology. CRC Press, NY.
4. Walker, C. H. , Hopkin, S.P., Silby , R. M. and Peakall, D. B. (2006). Principles of Ecotoxicology , Informa, CRC Press NY.
5. Wright, D.A. and Welbourn, R. (2002). Environmental Toxicology, Cambridge University Press, UK.

## **ZOL 943: Genetics: A Molecular Approach**

**Time: 3 Hrs.**

**Credit 3-0-0**

**Max. Marks : 100**

**Mid Semester Marks : 20**

**End Semester Marks : 80**

**Mid Semester Examination: 20% weightage**

**End Semester Examination: 80% weightage**

### **Instructions for the Paper Setters:**

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### **Section-A**

#### **Molecular Evolution:**

Early Atmosphere

Origin of life and informational macro molecules, origin of metabolism,

Ribozymes and the RNA world.

Evolution of DNA, RNA and protein sequences.

Molecular clocks to track evolutions, Ribosomal RNA,

Archaeobacteria vs eubacteria

DNA sequencing and biological classification

Microchondrial DNA, ancient DNA from extinct animals, Horizontal gene Transfer

### **Section-B**

#### **Nucleic acids- Isolation , Purification, detection and Hybridization**

Isolation and Purification of DNA

Gel electrophoresis of DNA

Chemical synthesis of DNA

Measuring concentration of DNA and RNA with ultra violet light

Radioactive Labelling of DNA and their detection

Hybridization of DNA & RNA, Southern, Northern and Western blotting

Zooblotting.

Fluorescence *In Situ* hybridization

### **Section-C**

#### **Genomics and DNA Sequencing**

Introduction to Genomics

DNA Sequencing – General Principle

The Chain Termination Method for Sequencing DNA

DNA Polymerases for Sequencing DNA

Producing Template DNA for Sequencing

Primer Walking along a Strand of DNA

Automated Sequencing



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The Emergence of DNA Chip Technology  
The Oligonucleotide Array Detector  
Pyrosequencing  
Nanopore Detectors for DNA  
Large Scale Mapping with Sequence Tags  
Mapping of Sequence Tagged Sites  
Assembling a Genome from Large Cloned Contigs  
Assembling Small Genomes by Shotgun Sequencing  
Assembling a Genome by Directed Shotgun Sequencing  
Sequence Polymorphisms : SSLPs and SNPs  
Gene Identification by Exon Trapping  
Bioinformatics and Computer Analysis

### Section-D

#### **Proteomics:**

The Global Analysis of Proteins.  
Introduction to Proteomics  
Gel Electrophoresis of Proteins  
Two Dimensional PAGE of Proteins  
Western Blotting of Proteins  
Mass Spectrometry for Protein Identification  
Protein Tagging Systems  
Full- Length Proteins Used as Fusion Tags  
Self Cleavable Intein Tags  
Selection by Phage Display  
Protein Interactions : The Yeast Two-Hybrid System  
Protein Interaction by Co-Immunoprecipitation

#### **Suggested Reading Material**

1. Brown, T. A. (2006) Gene cloning and DNA analysis and introduction (5<sup>th</sup> Edition), Oxford, Blackwell Publishers.
2. Lodish, H., Berk, A., Matsudaira, P., Kiser, C. A., Kriger, M., Scott, M. P., Zipursky, S.L. and Darnell, J. (2004) Molecular Cell Biology, 5<sup>th</sup> Edition W.H. Freeman and Company, New York.
3. Weaver, R.F. (2005) Molecular Biology,
4. Alberts, B., Johanson, A., Lewis, J. Raff, M., Roberts, M. and Walter, P. (2000) Molecular Biology of the cell, 4<sup>th</sup> Edition, Garland Science, New York.
5. DeRoberties, M. D. and DeRoberties, M.D. (Jr) (1995) . Cell and Molecular Biology (8<sup>th</sup> ed. ) B.I. Waverly, Pvt. Ltd., ND.

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6. Freifelder. D. (1993). Molecular Biology (2<sup>nd</sup> ed.) Narosa Publishing House, India
7. Freifelder. D. and Malacinski, G. M. (1993). Essentials of Molecular Biology (2<sup>nd</sup> ed), John and Bartlett Publishing, U.K.
8. Lewin B (2001) Genes VII, Oxford University Press, New York.
9. Primrose, S.B. , Twyman R.M. and Old R.W. (2001) Principles of Gene manipulation, 6<sup>th</sup> Ed. Blackwell Scientific Publication, Oxford, U.K.
10. Waston J.D., Tooze J. and Kurtz, D.T. (1991) Recombinant DNA. A short course 2<sup>nd</sup> Ed., W.H. Freeman and Company , New York.
11. Brown, T.A. (2001) Gene Cloning and DNA analysis, An Introduction, 4<sup>th</sup> Ed. Blackwell Scientific publication, Oxford, UK.
12. Christophger Howe (1995) Gene cloning and Manipulation, Cambridge University Press, New York.
13. Dale, J.W.Shantz MU (2002) From Genes to Genome: Concepts and Applications of DNA Technology, John Wiley & Sons, New York.
14. Micklos DHA, Greyer GA, Crotty DA and Freyer G (2002) DNA Science: A First Course in DNA Technology, 2<sup>nd</sup> Edition Cold Spring Harbor Lab Press, New York.