FACULTY OF LIFE SCIENCES

Syllabus

For

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

Examinations: 2019–20

Guru Nanak Dev University
Amritsar

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Pre Ph.D. Course in Zoology
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### Scheme of Courses

**Programme Code : ZOZ**

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

SECTION-B
3. Testing of hypothesis: Central limit theorem, null hypothesis and alternative hypotheses, Z-test, Student’s t-test, χ-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.
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.
References:


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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:
Pre Ph.D. Course in Zoology  
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ZOL-942: Principles of Toxicology  
Credit: 3-0-0  
Max. Marks : 100  
Mid Semester Marks : 20  
End Semester Marks : 80

Time: 3 Hrs.

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.

Section-A
1. History of Toxicology.  
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, Pharmaco Toxicology, Environmental Toxicology.

Books Recommended:
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ZOL 943: Genetics: A Molecular Approach

Credit 3-0-0  
Max. Marks : 100  
Mid Semester Marks : 20  
End Semester Marks : 80

Time: 3 Hrs.

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.

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,  
Archaeabacteria 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
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
3. Weaver, R.F. (2005) Molecular Biology,
    John and Bartlett Publishing, U.K.
    Scientific publication, Oxford, UK.
    New York.