FACULTY OF LIFE SCIENCES

SYLLABUS

FOR

Pre-Ph.D Course in Bio-Technology
(Credit Based Evaluation & Grading System)

Examinations: 2019-20

GURU NANAK DEV UNIVERSITY AMRITSAR

Pre-Ph.D Course in Bio-Technology
(Credit Based Evaluation & Grading System)

Scheme of Courses

Course Code	C/E/I	Course Name	Credits			Total Credits
			L	T	P	
LSL901*	C	Research Methodology	3	1	0	4
BTL902	C	Structural Biology & Bioinformatics	3	0	0	3
BTL903	C	Cell and Molecular Biology	3	0	0	3
BTL904	C	Advances in Biotechnology	3	0	0	3
BTS905	C	Seminar	0	0	1	1
	I	Interdisciplinary Course (Students may do from any other Department)	4	0	0	4
		Total Credits	16	1	1	18

* Common for Life Sciences

Pre-Ph.D Course in Bio-Technology
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LSL-901 - Research Methodology

Credits 3-1-0

Time: 3 Hrs.
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', ^{2}, F-distributions.
SECTION-B
3. **Testing of hypothesis**: Central limit theorem, null hypothesis and alternative hypotheses, Z-test, Student's t-test, -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.

Pre-Ph.D Course in Bio-Technology
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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.

Pre-Ph.D Course in Bio-Technology
(Credit Based Evaluation & Grading System)

BTL902-Structural Biology and Bioinformatics

Credits 3-0-0

Time: 3 Hrs.

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.

SECTION-A
Biological Databases
Biological databases, classification of database, example of different types data retrieval and data format, tools for DNA and protein sequence and structure analysis, Sequence Alignment, scoring matrices, dynamic programming. Types and algorithm of Blast, multiple sequence alignment.

SECTION-B
Protein structure and Function
Structure-function relationship using case studies, Structure determination: X-ray crystallography, Principle of NMR and CD, visualizing structure,structure alignment and classification, structure databases.

SECTION-C
Tools for Structure Determination
Structure prediction : Protein sequence analysis tools, secondary structure prediction, tertiary structure prediction homology modelling, fold recognition, ab initio methods structure visiualization and analysis tools, rasmol chimera spdviwer, Structure analysis Structural databases: PDB, PDBsum, NDB etc. SCOP, CATH.

SECTION-D
Phyllogenetics analysis
Phyllogenetics analysis, different type of evolutionary trees, molecular clock hypothesis, distance based method, maximum likelihood, maximum parsimony.

References:
1.   Date, C.J. (2003) An Introduction to Database Systems, 8th Ed. Addison Wesley.
2.   Mount D. W. (2004). Bioinformatics & Genome Analysis. *Cold Spring Harbor Laboratory Press.*
3.   Eidhammer I., Jonassen I. and Taylor W. R. (2004). Protein Bioinformatics: Analgorithmic approach to sequence and structure analysis. *Mathematics.*
4.   Bourhe P. E. and Weissig H. (2003). Structural Bioinformatics (Methods of structuralAnalysis). *Wiley-Liss.*
5.   C. Braden and C. Tooze (1991). Introduction to Protein Structure" *Garland PublishingInc., New York.*
6.   Sambrook, J., Fritsch, E.F. and Maniatis, T. (2000). Molecular Cloning: A LaboratoryManual,. *Cold Spring Harbor Laboratory Press, New York.*
7.   Recent Research articles from Journals

Pre-Ph.D Course in Bio-Technology
(Credit Based Evaluation & Grading System)

BTL 903 -Cell and Molecular Biology

Credits 3-0-0
Time: 3 Hrs.   **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.

SECTION-A
Stem Cell Biology : Stem cells- definition, classification and sources: embryonic stem cells, adult stem cells and mesenchymal stem cells; stem cells differentiation; Stem cells cryopreservation; clinical applications of stem cells; Mammalian Nuclear Transfer Technology;Stem cell based therapies and ethical considerations.

SECTION-B
Cancer Biology : Eukaryotic cell cycle, regulators of cell cycle progression, oncogenes, DNA repair defects and genomic instability in cancer cells, epigenetics and cancer, cancer genome, cell line based evaluation of anticancer agents, apoptosis and therapeutic aspects.

SECTION-C
Genomics and Proteomics: Overview of different strategies for gene silencing, RNA interference, construction of RNA interference vectors, Applications of RNA interference in crop improvements. Separation of proteins by 2-D Electrophoresis, identification of protein by MALDI-TOF MS, Protein microarrays

SECTION-D
Fermentation Technology
Down Stream Processing: Introduction, down stream processing, centrifugation and industrial centrifuges, filtration, precipitation, aqueous two phase system separations, liquid-liquid extractions, super-critical fluid extraction, Effluent treatments.

References:
1.   Spier, R.R. and Grifftths, J.B. (1994). Animal Cell Biotechnology, 6th Ed., Academic Press,London.
2.   Robert L. and other (2009) .Essentials of Stem Cell Biology. 2nd Ed. Academic Press,London.
3.   Recent Research articles from Journals
4.   Principles of Fementation Technology, Peter F. Stanbury; A. Whitaker; S.J. Hall. Aditya Books (P) Ltd. New Delhi 2009

Pre-Ph.D Course in Bio-Technology
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BTL 904 -Advances in Biotechnology

Credits 3-0-0
Time: 3 Hrs.   **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.

SECTION-A
Introduction to Tissue Engineering; role of scaffolds and growth factors; biomaterials and tissue engineering; organotypic and histotypic cultures; tissue replacement therapy; imaging tissue constructs

SECTION-B
Plant Cell Transformation: Strategies for plant cell transformation, regulation of expression of transgenes, selection of transgenic cells, screenable markers, validation of transgenes.

SECTION-C
Plant Tissue Culture & Medicinal Biotechnology : Medicinal natural products and their importance, Role of plant cell and tissue culture in medicinal plants, Genes and pathway discoveries, Metabolic engineering of alkaloid biosynthesis, Transport, accumulation and storage of secondary metabolites, Biotechnological approaches for quality control of medicinal plants

SECTION-D
Microbial Technology: Molecular approaches to study microbial diversity, the human microbiome project, comparative genomics, gene ontology and microbial sequencing projects, functional metagenomics for microbial enzyme discovery and bioactive metabolites frommicrobes.

Bioprocess Engineering

Bioreactors and Bioprocesses: Introduction, designing of bio-reactors, batch bioreactor designand its kinetics, continuous stirred tank bioreactors designing and its kinetics, steady statekinetics, fed batch bioreactors and its kinetics, quasy steady state condition, plug flowbioreactors and its kinetics.

References:
1.   Recent Review and Research articles.