DAV UNIVERSITY, JALANDHAR

Scheme of Courses for
Doctor of Philosophy - Biotechnology

Syllabus for Course Work

Course Syllabus Applicable to Admissions in 2017 Onwards

2017-18

Semester 1

S. No.	Course Code	Course Name	L	T	P	Cr	Course Type
1.	BCH801	Research Methodology in Life Sciences	4	0	0	4	**Core**
2.	BTY802	Seminar	0	0	0	2	**Core**
3.	BTY803	Scientific Writing	2	0	0	2	**Core**
4.		Departmental Elective	4	0	0	4	**Departmental Elective**
		Total	**12**	**0**	**0**	**12**	

List of Departmental Electives

S. No.	Course Code	Course Name	L	T	P	Cr	Course Type
1.	BTY804	Advances in Genetic Engineering	4	0	0	4	**Departmental Elective**
2.	BTY805	Advances in Genomics, Transcriptomics and Proteomics	4	0	0	4	**Departmental Elective**

L: Lectures T: Tutorial P: Practical Cr: Credits

Course Title: Research Methodology in Life Sciences
Course Code: BCH801

L	T	P	Credits	Marks
4	0	0	4	100

Objective:
To make the students learn how to design an experiment and what are the various research strategies.

Teaching Methodology:
Class room Lectures, practicals, models, charts, power point presentations.

Learning outcomes:
This course will impart the comprehensive knowledge of designing a research experiment, how to write a research paper, the relevant ethics, copy right, impact factor etc.

UNIT-I

Biostatistics: Definition and relevance in biological research; Measures of Central Tendency:Arithmetic Mean, median, mode, quartiles and percentiles; Measures of Dispersion: Range, variance, standard deviation, coefficient of variation; Skewness and Kurtosis.

Inferential Statistics: Hypothesis testing, Errors in Hypothesis Testing-Null Hypothesis, Alternative Hypothesis, Type I and Type II errors, Confidence Limits. Setting up of level of significance. One tailed and Two-tailed tests.

Correlation and Regression: Correlation coefficient (r), properties, interpretation of r, partial and multiple correlations, linear regression: Fitting of lines of regression, regression coefficient, Bivariate and Multiple Regression.

UNIT-II

Parametric and Non-Parametric Statistics: Definition, Advantages, Disadvantages, Assumptions; Parametric Tests: Student's t-test, One Way Analysis of Variance, Two Way Analysis of Variance; Non-Parametric Tests: Analysis of Variance, Chi square and Kendall Rank Correlation

Experimental Set-up: Basic principles and significance of research design; Randomized Block Designs (RBD), completely randomized designs (CRD); Latin square design and Factorial design

UNIT-III

Data collection, organization and interpretation.

Research articles, research papers, popular research articles and reviews; difference between periodicals; journals; monographs, magazines; proceedings.

How to write a research paper, reference styles, process of submission of a paper; process of proof reading of a research manuscript; process of reviewing.

Important journals in life-sciences.

An introduction to Science citation index; H-index, i10 index, Impact factor calculation, Impact factor of a journal; Eigen factor, Major journal search engines.

Copyright act; Academic frauds; Plagiarism; Softwares to check plagiarism.

UNIT-IV

Biosafety and Bioethics in Research: Guidelines for Biosafety and Bioethics; Safety practices and Bio-waste in the laboratory; Radioactivity and Safety; Fire hazards and safety; Institutional Biosafety,

Ethics and Animal Ethics compliance and concerns; Genetically modified organisms; Patents and Intellectual property rights; Reproduction of published material, Citation and acknowledgement; Guidelines for Ph.D. thesis.

Reference Books

1. Kothari, C.R.Research Methodology–Methods and Techniques. 2nd revised ed. New Delhi: New Age International (P) Ltd. Publishers, 2007. Print.
2. McKillup, S. Statistics Explained. An Introductory Guide for Life Scientists. Cambridge, UK: Cambridge University Press, 2006. Print.
3. Selvin, S. Biostatistics–How it Works. First Impression. New Delhi: Pearson Education Inc., 2007. Print.
4. Agarwal, B.L. Basic Statistics. New Delhi: New Age International, 2006. Print.

Course Title: Seminar
Course Code: BTY802

L	T	P	Credits	Marks
0	0	2	2	100

Seminar Objective:
During the course students will come to know about the general understanding of the most common problems, recent advances in biotechnology research. The instructor shall allot each student a topic. Student will have to understand the topic, collect literature and prepare the presentation. Through this the students will develop habit of reading newer topics, will become inquisitive and develop confidence of presentation and discussion before audience.
The students shall submit a project report on the allotted topic, which shall be evaluated by the concerned internal faculty. He/She then would present a seminar on the concerned topic. The students will be encouraged to explore all available literature as well as the internet to prepare the seminar report and present the same using informative slides made using Power Point or projectors.

Seminar Contents:
Students will present their work on a selected topic with the following headings:
• Title
• Objectives
• Review of Literature
• Materials and Methods
• Results
• Conclusion/recommendations

Examination Scheme (Weightage in %):
Literature study/ Fabrication/ Presentation : 50%
Written Report : 25%
Question answer session : 25%

Course Title: Advances in Genetic Engineering

L	T	P	Credits	Marks
4	0	0	4	100

Course Code: BTY804

Course Objectives:

The aim of this core-course is to acquaint the students to versatile tools and techniques employed in genetic engineering and recombinant DNA technology. A sound knowledge on methodological repertoire allows students to innovatively apply these in basic and applied fields of biological research. This course provides theoretical bases to properties and applications of versatile DNA modifying enzymes, cloning strategies, vector types, host genotype specificities, genomic and cDNA library and whole genome sequencing. This course will serve as a foundation course for the introduction of advanced cutting-edge technologies that essentially are an amalgamation of basic techniques combined in diverse forms.

Course Content

UNIT-I

Principles of Genetic Engineering

Genetic engineering, Gene cloning, overview of techniques, need and importance in present time, vectors- plasmids & bacteriophages, their features and use as vectors, other advanced vectors, their biology and use. DNA purification from various cells, importance of isolation techniques, methods of DNA manipulation and analysis, introduction of DNA into living cells, cloning strategies, sequencing and mutagenesis.

UNIT-II

Cloning Vectors for Genome Engineering

Cloning vectors for E.Coli, nomenclature, properties, selection techniques for vectors based on plasmids, detailed description of vectors based on bacteriophages. Cloning vectors for bacteria other than E.coli. Cloning vectors for Eukaryotes-Vectors for yeast and other fungi, cloning vectors for plants and animals.

UNIT-III

Applications of Genetic Engineering

DNA sequencing techniques and importance of cloning, techniques for studying gene expression and function, study of gene location and structure, study of biomolecules interactions, genome, transcriptopme, proteome and their identifications. Recombinant gene products and application in medicine, gene therapy, gene cloning and interpretation in agriculture, Gene analysis in archaeology and crimes.

UNIT-IV

Transgenic Technology and Advances

Gene engineering and transgenic generation, study of transgenic plants, their generation, underlying techniques and application, study of transgenic animals, generation and applilcations. Present status and future scope of transgenics in India and worldwide. Advances in genetic engineering techniques: Inducible expression systems, site specific recombination, gene inhibition, functional genomics.

Reference Books:

1. Advances in New Technology for Targeted Modification of Plant Genomes. Feng Zhang, Holger Puchta, James G. Thomson, Springer.
2. Genetic Engineering: Principles and Methods. Jane K. Setlow, Springer.
3. Gene Cloning and DNA Analysis: An Introduction. T.A Brown, Wiley Blackwell.
4. Principles of Gene Manipulation and Genomics. Sandy B. Primrose and Richard M. Twyman, Blackwell Publishing.

Course Title: Advances in Genomics, Transcriptomics and Proteomics

L	T	P	Credits	Marks
4	0	0	4	100

Course Code: BTY805

Course Objective: The aim of the course is to impart updated knowledge in the area of genomics, transcriptomics and proteomics, and how the methods are applied in real-life scientific research.

UNIT-I

Introduction to –omes and –omics. Gene, Genome and Genomics. Whole genome analysis: Preparation of genomic library in vectors, ordered cosmid libraries, BAC libraries, shotgun libraries. Genome analysis for global patterns of gene expression using fluorescent-labelled cDNA or end-labelled RNA probes. FISH, Sequencing: Conventional sequencing (Sanger, Maxam and Gilbert methods), automated sequencing, analysis of sequence information FISH. Analysis of single nucleotide polymorphism using DNA chips. Next generation sequencing using new technologies. Alignment of pairs of sequences of DNA and proteins. Multiple sequence alignment. Searching databases for similar sequences. Phylogeny: Different approache.0s to tree construction. Analyze sequences and its role in understanding the evolution of organisms and genes **16 hours**

UNIT-II

Transcriptomics. Microarray, EST, SAGE. Bioinformatical methods in transcriptomics. Application of transcriptomics. Genome sequencing projects (technology of sequencing and assembly, bioinformatics of genome annotation, current status of genome sequencing projects) Genomic browsers and databases Orthology prediction (comparative genomics), Search for transcription factor binding sites (TFBS), Computational prediction of miRNA target genes *De novo* prediction of regulatory motifs in genome, Single nucleotide polymorphisms (SNP) in medical genetics and basic research. **12 hours**

UNIT-III

Proteomics: Aims, strategies and methods. Bioinformatics tools in proteomics. Application of proteomics. Protein microarrays. Proteomics technologies: 2D-electrophoresis, MALDI-TOF mass spectrometry, yeast 2-hybrid system. Protein-protein interactions: experimental and computational methods, databases. Types of data and databases, quality of annotation. Protein structure prediction. The proteome. High throughput proteomics and its use to the biologists. Novel approaches to protein expression analysis: Scope of functional proteomics. Proteome analysis: 2DE based strategy. Alternatives to 2DE for protein expression analysis. Application of proteome analysis to drug development and toxicology: Basic principle and making use of the data. Protien-DNA interactions. Cancer profiling using DNA microarrays. Proteomics as tool for plant genetics and breeding. **15 hours**

UNIT-IV

Introduction to metabolomics. Technologies in metabolomics. Nutrigenomics. Nuclear Magnetic Resonance Spectroscopy and Mass Spectrometry in metabolomics. Metabolic pathways resources: KEGG, Biocarta. Nutrigenomics and metabolic health. Solved problems and future challenges. **6 hours**

Reference Books:

1. A primer of genome science (2009). Gibson G. and Muse S. V., (Sinauer Associates, Inc. Sunderland, MA).
2. Knowledge discovery in proteomics (2006). Igor Jurisica, Dennis Wigle (Chapman & Hall / CRC).
3. Proteomics: From protein sequence to function (2002). Pennington SR, Dunn M. J. (Viva Books Pvt. Ltd).
4. Informatics in proteomics (2005). Srivastava Sudhir (Taylor & Francis Group / CRC).
5. Genomics and proteomics engineering in medicine and biology (2007). Akay M. (Wiley-Interscience John Wiley & Sons, Inc. Publication, USA).
6. Essentials of genomics and bioinformatics (2002). Christoph W. Sensen (Wiley-VCH, Weinheim).
7. Current protocols in bioinformatics (2004). Baxevanis A.D., Davison, D.B., Page, R.D.M. & Petsko, G.A (John Wiley & Sons, Inc. Publications, New York).