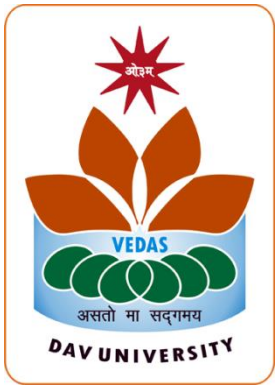
DAV UNIVERSITY, JALANDHAR



Scheme of Courses for
Doctor of Philosophy - Biotechnology

Syllabus for Course Work

Course Syllabus Applicable to Admissions in 2022 Onwards

2022-23

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.	BTY804	Advances in Genetic Engineering	4	0	0	4	**Core**
4.	BOT810	Research and Publication Ethics	2	0	0	2	**Core**
5.		Departmental Elective	4	0	0	4	**Departmental Elective**
		Total	**12**	**0**	**0**	**14**	

List of Departmental Electives

S.No.	Course Code	Course Name	L	T	P	Cr	Course Type
1.	BTY805	Advances in Genomics, Transcriptomics and Proteomics	4	0	0	4	**Departmental Elective**
2.	BTY806	Advanced Virology	4	0	0	4	**Departmental Elective**
3.	MIC802	Advances In Fermentation And Enzyme Technology	4	0	0	4	**Departmental Elective**

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

Course Name: Research Methodology in Life Sciences

Course Code: MBB801

Credits Components: Theory

Total Credits			
L	T	P	Credits
4	0	0	4

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

Course Contents:

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.

Patents and Intellectual property rights

Unit IV

Biosafety and Bioethics in Research: Guidelines for Biosafety and Bioethics; Copyright act; Academic frauds; Plagiarism; Softwares to check plagiarism. 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. Reproduction of published material, Citation and acknowledgement; Guidelines for Ph.D. thesis.

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.

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	0	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 Name: Research and Publication Ethics
Course Code: BOT810
Credits Components: Theory

Total Credits			
L	**T**	**P**	**Credits**
2	**0**	**0**	**2**

Course Objective: This course focuses on basics of philosophy of science and ethics, research integrity, publication ethics. Students will come to know about research misconduct and predatory publications. Indexing and citation databases, open access publications, research metrics and plagiarism tools will be introduced in the course.

Module 1 – Philosophy and Ethics

1. Introduction to philosophy definition, nature and scope, branches.
2. Ethics: definition moral philosophy, nature of moral judgments and reactions.

Module 2 – Scientific Conduct

1. Ethics with respect to science and research.
2. Intellectual honesty and research integrity.
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP).
4. Redundant publications duplicate and overlapping publications, salami slicing.
5. Selective reporting and misrepresentation of data.

Module 3 – Publication Ethics

1. Publication ethics: definition, introduction and importance.
2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest.
4. Publication misconducts: definition, concept, problems that lead to unethical behavior and vice versa, types.
5. Violation of publication ethics, authorship and contributorship.
6. Identification of publication misconduct, complaints and appeals.

PRACTICE

Module 4 – Open Access Publishing

1. Open access publication and initiatives.
2. HERPA/RoMEO online resource to check publisher copyright & self –archiving policies.
3. Software tool to identify predatory publication developed by SPPU.
4. Journal finder/ journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

Module 5 – Publication Misconduct

A) Group Discussions

1. Subject specific ethical issues, FFP, authorship.
2. Conflicts of interest.
3. Complaints and appeals: examples and fraud from India and abroad.

B) Software tools

Use of plagiarism software line Turnitin, Urkund and other open source software tools.

Module 6 – Databases and Research Metrics

A) Databases

1. Indexing databases .
2. Citation databases: Web of Science, Scopus, etc.

B) Research Metrics

1. Impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score.
2. Metrics: h-index, g index, i10 index, Altmetrics

Course Name: Advances in Genetic Engineering
Course Code: BTY804
Credits Components: Theory

Total Credits			
L	T	P	Credits
4	0	0	4

Course Objective: 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 Contents:

Unit I

Principles of Genetic Engineering

Genetic engineering, Gene cloning: need and importance, overview of techniques, vectors-plasmids & bacteriophages, their potential as vectors, other advanced vectors, their biology and use. DNA purification from various cells, importance of isolation techniques, methods of DNA manipulation and analysis, tranformation, 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 applications. 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, HolgerPuchta, 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 Name: Advanced Virology
Course Code: BTY806
Credits Components: Theory

Total Credits			
L	T	P	Credits
4	0	0	4

Course Objective: This course deal with the classical as well as modern concept of virology plant as well as animal virology, as biological concept arising from the virology. Role of plant and animal viruses in agriculture and human health.

Course Contents:

Unit I

History and development of virology, taxonomy of viruses (earlier classification systems) and viroids, significance of virology and latest ICTV classification of viruses. Origin and evolution of viruses. Principles of biosafety, containment facilities, maintenance and handling of laboratory animals and plants.

Unit II

Propagation, purification, characterization, identification and genomics of viruses. Methods of virus diagnosis, detection, assays and comparison of their sensitivities. Structure of viruses and methods employed in structural and functional genomics of the viruses.

Unit III

Symptoms of plant virus diseases, transmission of plant viruses, viral and viroid diseases and their control: General discussion on symptoms caused by viruses and viroids in diseased economically important trees and agricultural crops, and their control. Microbial viruses: Diversity, classification, characteristics and applications of bacteriophages, and general account on algal, fungal and protozoan viruses. Virus-like agents: Prions, satellite DNAs and RNAs, satellite viruses; defective interfering particles and virophages.

Unit IV

Virus replication Strategies: Principal events involved in replication: Adsorption, penetration, uncoating nucleic acid and protein synthesis, intracellular trafficking, assembly, maturation and release, viral-host interaction, Host response to viral infection.Anti-viral strategies: prevention and control of viral diseases. Introduction to recent trends in management and control of viral diseases. Introduction to applications of plant and animals viruses.

Reference Books:

1. Principles of Virology: Molecular Biology, Pathogenesis and Control of Animal Viruses (2003). Flint, S.J., Enquist, L.W., Racaniello, V.R. and Skalka, A.M. 2nd Edition, ASM Press, Washington, DC. Print. *ISBN*: 978-1-55581-479-3.
2. Introduction to Modern Virology (2007). Dimmock, N., Easton, A. and Leppard, K.6th Edition. Wiley-Blackwell. Print. ISBN-13: 978-1405136457
3. Basic Virology (2007). Wanger, E.K., Hewiett, M., Bloom, D. and Camerini, D. 3rd edition, Wiley-Blackwell. Print. ISBN : 978-1-4051-4715-6
4. Principles of Molecular Virology (2011). Cann, A.J. 5th Edition. Elsevier Academic Press. Print. *ISBN:* 9780123849397, 9780123851741
5. Plant Virology (2013). Hull, R. 5th Edition. Academic Press. Print. *ISBN* 9780123848710, 9780123848727.
6. Principles of Molecular Virology (2001). Alan J. Cann, 3rd edition, Elsevier Academic

Press. *ISBN* 9780080886909
7. Plant Virology (2002). Roger Hull, 4th edition, Academic press. 978-0-12-361160-4

Course Name: Advances In Fermentation and Enzyme Technology
Course Code: MIC802
Credits Components: Theory

	Total Credits		
L	**T**	**P**	**Credits**
4	**0**	**0**	**4**

Course Learning Objective: The objective of the course is to help the students in comprehending the various aspects of microbial fermentation including various types of fermentations, kinetics of growth, production and sterilization as well as recent advances in production of various microbial enzymes and their applications.

Course Content:

Unit-1

Fermentation: Submerged and solid state fermentations, Types of fermenters, Design and operation of Fermenters, Concepts for selection of a reactor. Growth and product formation kinetics: Monod growth kinetics, Kinetics of colony formation and pellet growth. Concepts for calculation of yield coefficient, specific growth rate, specific productivity. Biomass and substrate balance calculations for chemostat, chemostat with recycles. Multistage chemostat systems and fed-batch systems.

Unit -2

Stoichiometry of cell growth: Elemental balance, Electron balance, Theoretical calculation of oxygen demand, Upper limit of yield and energy changes occurring due to growth and product formation.

Sterilization: Kinetics of cell death and nutrient degradation during heat killing; Batch and continuous sterilization; Scale up of sterilization. Brief account of Downstream processing: Downstream process economics, Cost cutting strategies in downstream processing industry.

Unit -3

New strategies for isolation of industrially important microbes and their genetic manipulations; Microbial production of health care products. Enzymes: commercial applications; Production of industrially important enzymes such as Amylases, Proteases, Lipases, Enzymes used for analytical purpose: Glucose oxidase, cholesterol oxidase; Medicinal enzymes: L-Asparaginase.

Unit -4

Techniques of enzyme immobilization; Kinetic Parameters for soluble and Immobilized Enzyme Systems, Reactors for Enzyme Catalyzed Reactions. Idealized Enzyme Reactor Performance, Mass transfer limitations in immobilized enzyme reactors.

Learning outcomes: The students will be able to gain knowledge about the various developments in the field of fermentation as well as their potential application in different aspects of life.

Suggested Readings:

1. Stanbury PF, Whitaker A, Hall SJ. Principles of Fermentation Technology. 2nd edition.,Elsevier Science. 1995. Print

2. Glazer AN and Nikaido H. Microbial Biotechnology. 2nd edition, Cambridge University Press. 2007. Print

3. Demain, A. L and Davies, J. E. Manual of Industrial Microbiology and Biotechnology. 2nd Edition, ASM Press. 1999. Print

4. Swartz, J. R. Advances in Escherichia coli production of therapeutic proteins. Current Opinion in Biotechnology, 12, 195–201. 2001. Print

5. Willey JM, Sherwood LM, WoolvertonCJ.Prescott, Harley and Klein's Microbiology. 10th edition, McGraw Hill Publishers. 2016. Print

Websites and Audio Video lectures:

1. https://nptel.ac.in/courses/102105058/
2. https://swayam.gov.in/course/3716-industrial-biotechnology
3. https://www.coursera.org/lecture/industrial-biotech/microbial-fermentation-processes-and-bioreactor-design-35cbb
4. https://freevideolectures.com/course/85/enzyme-science-and-engineering