

Dr. D. Y. Patil Vidyapeeth, Pune
Pre-Ph.D. Course Syllabus- Biotechnology
Structure of Pre-Ph.D. Course Work for Biotechnology

Sr. No.	Paper	Title	Credits	Contact Hours	Marks
1	I	Research Methodology and Statistics (Section A and B)	04	60	50
2	II	Recent developments in concerned discipline	02	30	50
3	III	Advanced study of sub discipline	02	30	50
4	IV	Presentation and discussion	02	30	50
		Total	10	150	200

Paper-I Research Methodology and Statistics (Section A and B) (04 credits, 60hours)

Section A

S. N.	Topic	Sub topic	Contact Hours
1.	Introduction	An overview of research methodology Defining the research problem	02
2.	Hypothesis	What is hypothesis Research hypothesis and Null hypothesis	02
3.	Research Design	Meaning of research Objective of research Motivation of	02
4.	How to prepare a research proposal	Literature survey for the proposed research Work	02
5.	How to conduct field	Sampling fundamentals Important sampling	03
6.	Methods of data and information collection	Collection of primary data Observation method Interview method Method of data collection Collection of secondary data Selection of appropriate method for Data collection	06
7.	Experimental designs	Design of experiments, completely randomized and randomized block design. Factorial experiments, missing plot Technique Modelling and simulation	06
8.	Scientific writing and publication	Interpretation, technical Report writing and presentation (oral/poster), Overhead projector powerpoint slides, Journal selection, Impact factor	07
	Total		30

Section B

S. N.	Topic	Sub topic	Contact Hours
1.	How to conduct field	Sampling fundamentals Important sampling distributions	03
2.	Processing and analysis of data	Basic statistical techniques Mean, Median, Mode etc. Analysis of variance, Chi-square test, ANOV A standard deviations, F- and t-test. Tabular and graphical presentation of data, Histogram, frequency polygon, pie chart. Parametric and Non parametric tests,	08
3.	Measurement and scaling technique	Refining Skills in Regression Analysis Advanced Multivariate Analysis	05
4.	Sampling errors	Theory of errors Errors and residuals, precision, measure of precision, Probable error of function, rejection of observation, DEA technique for decision making	06
5.	Computer aided statistical Analysis	Electronic data processing, operating system-common software available, Internet applications, database and bioinformatics. Use of statistical software packages-SPSS	08
	Total		30

Paper II: Recent Developments in Biotechnology (02 credits, 30 hours)

Sr. No	Details	Contact hours
1	Biology of Cultured Cells	01
	Animal Cell Culture	01
	Cloning & Selection	01
	Organ & Histotypic Cultures and Tissue Engineering	01
	Gene therapy	01
	Transgenic Animals	01
	Immunobiotechnology	01
	Transplantation Immunology	01
2	Introduction to plant biotechnology	01
	Plant Tissue Culture	01
	In vitro hybridization	01
	Plant Transformation Technology	01
	Plant Metabolic Engineering	02
	Plant Molecular Markers	02
3	Advances in bacterial taxonomy	01
	Advances in Microscopy and microscopic techniques	02
	Metagenomic applications in Microbiology	02
	Molecular techniques in cloning and gene expression	01
	Biochemical techniques	02
4	Biological Databases	01
	Sequence Alignment	01
	Systems Biology	01
	Experimental Techniques	01
	Drug Designing Techniques	01
	Algorithms in Bioinformatics	01

Reference Books:

1. Culture of Animal Cell by R. Ian Freshney. 5th Edition., Wiley-Liss.
2. Biotechnology by U. Satyanarayana, Books and Allied (P) Ltd, Kolkata.
3. Gene Transfer to Animal Cells - R.M.Twyman, Publisher : Garland Science/BIOS Scientific Publishers, 2005, ISBN 0-203-48923-3
4. Animal Biotechnology 2nd edition. - M. M. Ranga, Publisher: Agrobios India, ISBN: 81- 7754-155-2
Practical Application of Plant Molecular Biology by .R.J. Henry: Chapman and Hall. 1997
5. Maarten J. Chrispeels and David E. Sadava. Jones (2002) Plants, genes and agriculture Bartlett Publishers, 1 Exeter Plaza, Boston, USA.
6. Harvinder Singh Chawla (1998) Biotechnology in Crop Improvement IBD Publishers.

7. Razdan MK (2003). Introduction to Plant Tissue Culture, Oxford-IBH Publishers
8. Mantel, Mathews and Mickee (1985). An introduction to genetic engineering in plants. Blackwell Publishers.
9. Molecular Farming: Plant made pharmaceuticals and technical proteins. Eds. Rainer Fischer and Stefan Schillberg (2004).
10. Manual of Environmental Microbiology, 3rd Edition 2007, Editors: Christon J. Hurst, Ronald L. Crawford, Jay L. Garland, David A. Lipson, Aaron L. Mills, Linda D. Stetzenbach, ASM Press Title: Manual of Environmental Microbiology, 3rd Edition
11. Methods for General and Molecular Microbiology, 3rd Edition, 2007, Editors: C. A. Reddy, Terry J. Beveridge, John A. Breznak, George Marzluf, Thomas M. Schmidt, Loren R. Snyder, ASM Press 3
12. Lehninger Principles of Biochemistry 5th Ed 2009, Dave Nelson and Mike Cox Publisher WH Freeman.
13. Genes IX, Lewin, Benjamin 2007, CBS Publishers and Distributors
14. Molecular Biology of the Gene 6th Edition 2008 Ed James Watson, Tania Baker, Stephen Bell, Alexander Gann, Michael Levine, Richard Losick Pearson Education
15. Electron Microscopy: Principles and Techniques for Biologists By John J. Bozzola, Jones & Bartlett Learning, 2011.

Sub-discipline 1: (2 Credits)

Sr. No.	Details	Contact hours
1	<p>Introduction to Stem Cells (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). Reprogramming of Somatic Cells to induced pluripotent Stem cells (iPS), Application of iPS technology to Regenerative Medicine. Developmental hematopoiesis, Epigenetic regulation of stem cell fate, Niche biology: regulation of hematopoiesis by the niche-mediated signaling mechanisms. Cryopreservation of cells (general), Cord blood banking and long-term storage of stem cells, FACS and its application in stem cell research. Neural stem cells and differentiation. Embryonic stem cells, Cancer stem cells. Mammalian Nuclear Transfer Technology; Stem cell based therapies and ethical considerations.</p>	12
2	<p>Cancer gene Regulation and epigenetics. Cellular signalling in Cancer. Cancer stem cell; Molecular classification of biomarkers; Cancer therapeutics; Cancer Immunotherapy; Animal models in cancer; Histopathology in cancer diagnosis and prognosis. Eukaryotic cell cycle, regulators of cell cycle progression, oncogenes, DNA repair defects and genomic instability in cancer cells. Cell line based evaluation of anticancer agents, apoptosis and therapeutic aspects.</p>	10
3	<p>Biologics and molecular medicine in immunology (cytokines, chemokines, cell-adhesion molecules, co-stimulatory molecules and surface receptor and ligands as therapeutic targets). Role of non-coding RNA in immune regulation. Advanced immunological techniques: Flow cytometry, Magnetic sorting, MHC tetramer technology, multiplex assays. Antibody purification and protein conjugations, spectratyping, surface plasmon resonance (SPR). Animal model of immunological diseases (Transgenic and knockout animals). Generation of bone-marrow chimeras, humanized mice, parabiosis.</p>	08

Reference Books:

1. Biotechnology by U. Satyanarayana, Books and Allied (P) Ltd, Kolkata.
2. Gene Transfer to Animal Cells - R.M.Twyman, Publisher : Garland Science/BIOS Scientific Publishers, 2005, ISBN 0-203-48923-3
3. Animal Transgenesis and Cloning - Louis-Marie Houdebine, Publisher : John Wiley & Sons, 2003, ISBN: 0-470-84827-8
4. Animal Biotechnology 2nd edition. - M. M. Ranga, Publisher: Agrobios India, ISBN: 81-7754-155-2
5. Basic and Clinical Immunology - Stites DP, Appleton & Lang Press.
6. Animal Cell biotechnology, 6th Ed. - Spier, R.R. and Griffthts, J.B. (1994). Academic Press.
7. Essentials of Stem Cell Biology. 2nd Ed. - Robert L. and other (2009). Academic Press, London.
8. Recent Research articles from National and International peer-reviewed Journals

Sub-discipline 2: (2 Credits)

Sr. No.	Details	Contact hours
1	Introduction to plant biotechnology applications	2
2	Chromatographic techniques: techniques and applications. Paper and classical column (Preparative and analytical) chromatography, TLC, liquid chromatography: HPLC, gas chromatography. Electromagnetic spectrum. Applications of UV, IR, NMR and Mass spectrometry in the structural elucidation of phytoconstituents. Interpretation spectral data of IR, HNMR, ¹³ CNMR, mass spectroscopy in the characterization of organic medicinal compounds	5
3	General aspects involved in the cultivation of medicinal plants. Conservation of medicinal plants: ex-situ and in-situ cultivation. Different areas and applications of plant tissue culture. Micro propagation (Organogenesis, Somatic Embryogenesis, Shoot tip culture, Rapid clonal propagation) of medicinal plants.	7
4	Plant Genome organization and characterization Nuclear Genome, Organellar Genomes, Status of Plant Genome Sequencing and its applications, Structure of Plant Gene and Gene Families. Molecular Markers. Genome mapping and applications. EST's and cDNA	6
5	Introduction. Enzymes and vectors in genetic engineering, concepts of cloning, cDNA and genomic libraries, cloning for production of biopharmaceuticals, Screening and detection methods for clones. Application of Transgenic Plants: - Bt cotton and Pest Resistance, Herbicidal Resistance, Viral Resistance, Disease Resistance, Abiotic stress resistance	8
6	Introduction to bioinformatics overview and its applications in plant biotechnology	2
		30

References:

1. Harvinder Singh Chawla (1998) Biotechnology in Crop Improvement IBD Publishers.
2. Donal Grierson and Convey S. V. (1988). Plant Molecular Biology, Routledge
3. Maarten J. Chrispeels and David E. Sadava. Jones (2002) Plants, genes and agriculture Bartlett Publishers, 1 Exeter Plaza, Boston, USA.
4. Mantel, Mathews and Mickee (1985). An introduction to genetic engineering in plants. Blackwell Publishers.
5. Slater, A, Scott, N. and Fowler, M. (2003). Plant Biotechnology: The Genetic
6. Manipulation of Plants. Oxford Press.
7. Razdan MK (2003). Introduction to Plant Tissue Culture, Oxford-IBH Publishers
8. Instrumental methods of chemical analysis by Chatwal. K, anand, 5th edition.
9. Vogel's text book of quantitative chemical analysis by G.H.Jeffery, J.Bassett, J.Mendhan, R.C.Denny.

Sub-discipline 3: (2 Credits)

Sr. No.	Details	Contact hours
1	Metal toxicity in plants, humans and other animals Metal tolerance in microbes Adsorption and accumulation of metals by bacteria Mechanism of metal tolerance Use of hyperaccumulators in remediation of metal polluted	10
2	Classification of habitats based on geological and environmental properties- identification of pristine habitats Advanced isolation and sampling techniques Advanced techniques of screening for production of target biomolecules Industrial potential of selected strains	10
3	Bioelectrochemistry principles Electron transport in bacteria Microbial fuel cells Generation of electricity using waste- principles and technological implications	10
		30

Reference Books:

1. Bioelectrochemistry of Membranes Series: Bioelectrochemistry: Principles and Practice, Vol. 6, Walz, Dieter, Teissié, Justin, Milazzo, Giulio (Eds.) 2004, Springer Verlag, Germany. pp 240.
2. Bioremediation: A Critical Overview. Head, I.M., Milner, M., Singleton, I. (Eds.) 2002, Springer Verlag, Germany. pp 400.
3. Disregarded Microbial Diversity and Ecological Potentials in Aquatic Systems Series: Developments in Hydrobiology, Vol. 216, Sime-Ngando, Télesphore, Niquil, Nathalie (Eds.) 2011, Springer Verlag, Germany. pp 118.
4. Microbial ecology: fundamentals and applications. Atlas, R. M.; Bartha, R. 1981, pp 560.
5. Microbial Diversity and Bioprospecting, Alan T. Bull, ASM Press, 2004, pp 496.
6. Microbial Diversity: Form and Function in Prokaryotes, Oladele Ogunseitan, 2008, Wiley-Blackwell, pp 312.

Paper IV: Presentation and Discussion

(02 Credits, 30 hours)

The presentation of the Research topic by the candidate will be evaluated by an Expert Committee. The candidate will be required to make a presentation under the following headings —

- (1) Need for Selection of the topic.
- (2) Aims & Objectives
- (3) Current Scenario (In relation to topic of research)
- (4) Detail study plan
- (5) Evaluation Parameters
- (6) Expected impact of study / Implications

He/She will also be required to provide a brief report (10 sets) of the contents of the presentation (not exceeding 10 pages) to the members of the Committee.

The Expert Committee will be constituted by the Vice-Chancellor on the recommendations of the Dean of the concerned faculty.

Evaluation:

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*The student should obtain a minimum of 55% marks in order to be declared successful at the Pre-Ph.D. examination.

