SCHOOL OF BIOTECHNOLOGY, D.A.V.V., INDORE.

SYLLABUS FOR Ph.D. COURSE WORK (BIOTECHNOLOGY)

COURSE	TITLE	CREDITS
COURSE-I	Research Methodology	4
COURSE-II	Advanced Biotechnology	3
COURSE-III	Computer Application	3
COURSE-III	Review of Literature	3
	Comprehensive Viva-Voce	3
	Total Credits	16

COURSE-I
Research Methodology   4 Credits

Objective: To gain knowledge about research in general, experimental approaches and analyses tools

Unit 1: Introduction to research

Concepts of research, discovery, innovation, invention. Concepts of blanks, controls and experimental designs of different nature of experimentations. Formulation of research problem, hypothesis, hypothesis generation, null hypothesis, alternate hypothesis, data collection and sampling methodologies.

Unit 2: Research ethics

Nature and purpose of ethics, Bioethics and biosafety protocols for biotechnological research; Animal ethical issues, IPR and patenting issues, conflict of interest, plagiarism, research misconduct, authorship, mentoring, social responsibilities of researchers.

Unit 3: Statistical methods

General overview of statistics- Mean, mode, median, standard deviation, standard errors, t-test, chi square test, multiple comparison tests (post hoc tests), ANOVA, correlation coefficient, level of significance, use of statistical tools (MS-EXCEL, Prism, SPSS) for different types of statistical tests. Probability distributions-Normal, Bionomial and Poisson distribution. Parametric and non-parametric statistics.

Unit 4: Scientific and technical writing

Introduction to publications. Research Journals (types), Peer review process, paper submission (off and online mode). Paper writing steps and process. Paper presentations, Report writing (Including pre-writing considerations and thesis writing).

Unit 5: Soft skills and Personality development

Concept of happiness and the ways to become happy; Differentiation among dreams, goals and objectives; Johari's window model to convert unknown into known. Paraphrasing and features of a good presentation for lectures and research, importance of dialogues/ communications & discussions- and the ways to improve them.

<div align="center">**COURSE-II**

Advance Biotechnology   3 Credits
</div>

Objective: To gain knowledge and applicability of advance tools and techniques used in biological research

Unit 1: General techniques used in Biotechnological research

Gel electrophoresis of DNA, RNA and protein. Southern, Northern and Western Blotting techniques. Fluorescent in situ hybridization (FISH), Electron microscopy- Transmission electron microscopy (TEM) and Scanning electron microscopy (SEM), Fluorescence microscopy and Inverted microscopy. Techniques used for protein/ antigen detection-Enzyme linked immunosorbent assay (ELISA), Radioimmuno assay (RIA), Fluorescence activated cell sorting (FACS). Animal tissue culture techniques- Culturing of the mammalian cells, their maintenance and experimentation using cell lines; Plant tissue culture techniques-Media preparation, Explant preparation and processing, artificial seeds preparation, anther culture, pollen culture, somatic embryogenesis, callus culture, sterilization and plating techniques.

Unit 2: Genomics based tools and techniques

Genome sequencing techniques and applications- Next-Generation sequencers, Sequencing strategies and the shotgun method, Massive parallel sequencing and their applications.

Applications of gene structural components such as coding sequences (CDS), untranslated regions (UTR's), expressed sequence tags (EST) etc. Types of gene polymorphism and their effects. Gene-disease association and polygenic diseases.

Unit 3: Transcriptomics based tools and techniques

Insights into Microarray, Serial analysis of gene expression (SAGE), real time PCR and their applications in high throughput gene expression studies. Gene expression through epigenetic regulation, mi-RNA & si-RNA pathways, antisense RNA technology.

Unit 4: Proteomics based tools and techniques

Tools for proteome analysis such as isoelectric focusing (IEF); Two dimensional PAGE, Mass spectrometry (MS-MS; MALDI-TOF), multidimensional HPLC. Protein structural determination by X-Ray crystallography, NMR, circular dichroism (CD). Antibody-array, Yeast hybrid systems for protein-protein and protein RNA interactions, FRET, BRET, Co-immunoprecipitation.

Unit 5: Metabolic engineering and recombinant DNA technology

Extension and diversion of metabolic pathways for production of commercially important products. Expression vectors, plantibodies, bioreactors, edible vaccines, development of knockout animal models and animal cloning. Production of transgenic crops, diagnostics and therapeutics using recombinant DNA technology.

Computer Applications 3 Credits

Objective: To gain theoretical background and practical experience of various computer software and statistical tools for research applications

Unit 1: MS Word

Features and applications related to presentation of text in suitable format and saving the data for future applications. Practical knowledge of MS Word to type the script, insert tables, figures, and graphs to prepare thesis and research papers in presentable format.

Unit 2: MS Excel

Use of worksheets to enter experimental data, edit data, copy data and move data in the excel sheet. Use of in built statistical functions for computations of means, standard deviation, correlation, regression coefficients etc. Preparation of bar diagram, histogram, charts, and scatter plots in EXCEL for presentation of data.

Unit 3: MS Power Point

Preparation of Power point presentations, insertion of figures, graphs, charts in presentation, preparation of scientific posters for presentations; Use of various formatting and presentation techniques.

Unit 4: Use of SPSS & Internet Applications

Methods of preparation of data sheets and entering the data according to its characteristics. Use of various statistical tools on SPSS. Overview of networking, Internet and its applications. Exploring various websites and search engines for collecting quality literature and secondary data related to research work.

Unit 5: Basic Bioinformatics

Bioinformatics and its relation with advanced biology. Examples of related tools (FASTA, BLAST, RASMOL), Databases (GENBANK, Pubmed, PDB) and software (RASMOL, Ligand Eplorer). Introduction to sequences and alignments; Local alignment and Global alignment, Phylogenetic analysis.

<div align="center">

COURSE-IV
Review of Literature **3 Credits**

</div>

Objective: To collect the available literature in the chosen field of research, preparation of chronological order about the development of research in the specific area, identification of gaps in knowledge and developing the planning and methodology to fill the gaps.

Sources of research material, literature survey, compiling records. Various types of scientific documents- Original research paper, review paper, book chapter, theses, project report and conferences.

Components of a research paper-IMRAD system, title, author, and addresses, abstract.

Dealing with publishers-submission and review process.

Oral and poster presentations of research work in conferences/ symposia.

Skill development for communication of research findings to scientific community and for general audience.

Comprehensive Viva-Voce: As per provision of Ordinance-14, student will have to appear for comprehensive Viva-Voce.