

# DEPARTMENT OF BIOTECHNOLOGY

## SYLLABUS OF Ph.D. PROGRAMME



**RAMA DEVI WOMEN'S UNIVERSITY**  
Vidya Vihar, Bhubaneswar-751022, Odisha  
Website: <https://rdwu.ac.in>

# DEPARTMENT OF BIOTECHNOLOGY

## SYLLABUS OF Ph.D IN BIOTECHNOLOGY



**RAMA DEVI WOMEN'S UNIVERSITY**  
Vidya Vihar, Bhubaneswar,  
ODISHA

*M. S. Patil*  
20/8/23  
Controller of Examinations  
R.D. Women's University  
Bhubaneswar

## OUTLINE OF THE COURSE STRUCTURE

<b>Sl. No</b>	<b>Paper code</b>	<b>Course Title</b>	<b>Credit</b>	<b>Marks</b>	<b>Pass Mark</b>
1	BT01	Research Methodology & Computer Application	4	100	50%
2	BT02	Advances in Biotechnology	4	100	50%
3	BT03	Presentation of Review Literature	4	100	50%
4	BT04	Research & Publication Ethics	4	100	50%
<b>TOTAL</b>			<b>16</b>	<b>400</b>	

## **Ph.D. Biotechnology Programme**

### **outcomes:**

**PO1:** This degree programme provides opportunity to students to study the application of biotechnology in depth which someone may wish to apply for building blocks in area of research.

**PO2:** Inculcate scientific communication skills, scientific writing and data recording required for Pharma industry, hospital Regulatory Agencies, & Academia.

**PO3:** Demonstrate the ability to work on research projects and assignments.

**PO4:** Enhance the ability of the students to take research initiative, design strategies with social cohesion between research and social context.

**PO5:** Aware about ethical issues and challenges related to biotechnology.

**PO6:** Acquire knowledge for in-depth analytical and critical thinking to identify, formulate and solve the issues related to various aspects of Biotechnology.

**PO7:** Proficient knowledge in the lead domains of biotechnology including Bioprocess technology, Animal biotechnology, plant Biotechnology, microbiology, genetic engineering, and Bioinformatics.

**PO8:** Demonstrate the ability to use digital tools and softwares for mining and analyzing data related to biotechnology.

**PO9:** Enhanced ability for collaborative research work with different scientific community.

**PO10:** An ability to demonstrate a critical awareness of current gaps in research and practice in the field.

### **Program specific outcomes:**

**PSO 1:** Doctoral research helps in shaping the future of specialist by individual cognitive activities aimed at obtaining new, knowledge, solving theoretical and practical problems, self-education and self-realization.

**PSO2:** To demonstrate and apply their knowledge of cell biology, biochemistry, microbiology and molecular biology to solve the problems related to the field of

biotechnology.

**PSO3:** To understand various facets of molecular procedures and basics of genomics, proteomics and metabolomics that could be employed in early diagnosis and prognosis of human diseases.

**PSO4:** To familiar with basic laboratory instruments and understand the principle of measurements using those instruments with experiments.

**PSO5:** To understand, analyse and implement the knowledge related to research ethics, intellectual property rights and patent formulation.

**PAPER 1: RESEARCH METHODOLOGY & COMPUTER APPLICATION  
(4 CREDITS) (100 Marks)**

**Course Outcome:**

On successful completion of this course, student will be able to:

- Gain knowledge of ethical issues related to Research and Publication, patents and rights and intellectual property rights.
- Able to review of existing work in the field of choice.
- Use of open courseware like INFLIBNET, ShodhGanga etc.
- Use computing skills and computer applications in research to draw reasonable, accurate conclusions
- Utilize the tools/software like LaTeX, MS-Office, Active Scholar and alike.

**Unit-I: Introduction to Research Methodology**

Importance and Meaning of Research; Characteristics, Objectives and Motivations in Research; Types of Research; Significance of Research; Research Process and steps; Criteria for good research; Identification, selection and formulation of research problems; Research Design- meaning, need, features of a good design, basic principles of experimental designs, important concepts and different research designs, Developing a research plan, Sample design and its types, Characteristics of sampling procedure.

**Unit-II: Data Collection, hypothesis testing and analysis in Biotechnology**

Frequency distribution, Diagrammatic representation, Probability Distribution, Binomial distribution, Measure of dispersion (range, mean deviation, variance, standard

deviation, variance, coefficient of variation), Normal distribution: its importance and properties. One- tailed versus two-tailed tests, p-value, hypothesis testing, student t-test, paired t-test and Chi- square test; Correlation and Regression; Analysis of Variance: One-way and Two-way ANOVA, F-Distribution and application.

### **Unit-III: Scientific Writing, Research ethics and Intellectual Property Rights (IPR) in Biotechnology**

Interpretation of data and scientific report writing: Significance of report writing, Different steps, Layout of the research report, Types of Reports; Laboratory Biosafety, Good Laboratory practices (GLP) and Good Manufacturing Practice (GMP), Ethics in manipulation of cells, tissues and animals; Introduction to IPR, Types of IP - Patents, Trademarks, Copyright and Related Rights, patentable and non-patentables, legal protection of Biotechnological inventions.

### **Unit-IV: Practicals on Computer Applications**

Approaches to Computer Application: MS Word: Working with Text, Working with Tables, Graphics and Pages, Document Views and Formatting, and Mail-merge, and Referencing Style; MS-Office and its application, File handling in window, various versions of MSOffice, Research publishing tool- MS-Word, Adobe acrobat, Graphics tool- MS Excel, MS-Power Point: Creating presentations and adding effects, Subject/field specific tools on [www.freeware.com](http://www.freeware.com); Use of Internet: Fundamentals and Services – E-mail, FTP, Telnet, WWW

### **Suggested Readings:**

1. D. R. Cooper and P. S. Schindler, Business Research Methods, 9/e, TMH, 2009.
2. C. R. Kothari, Research Methodology, 2/e, New Age International (P) Ltd. Publishers, 2006.
3. Jerrold H. Zar, Biostatistical Analysis (4th edition), Prentice Hall publishers. 1998
4. Fundamentals of Biostatistics, Veer Bala Rastogi, Ane Books India, New Delhi, 2006
5. Anderson, J; Durston, D and Poole, M. Thesis and Assignment writing. New Age International Pvt. Ltd, New Delhi, 1991
6. Conference of Biological Editors, Style manual for Biological Journals, American Institute of Biological Science, Washington, D.C, 2000
7. Padma Nambisan, An Introduction to Ethical, Safety and Intellectual Property Rights Issues in Biotechnology, 1st Edition, Academic Press, 20

## **MAPPING OF COURSE OUTCOMES WITH THE PROGRAM OUTCOMES**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	5	5	4	5	2	4	5	5	5	4
CO2	5	4	5	5	5	4	5	4	2	2
CO3	4	5	4	4	2	5	5	5	5	2
CO4	5	5	5	5	5	2	4	4	4	4
CO5	5	5	5	5	5	5	5	4	5	5

- Note related: 1
- From What Related: 2
- Nutral: 3
- Moderately Related: 4
- Highly Related: 5

## **PAPER 2: ADVANCES IN BIOTECHNOLOGY**

**(4 CREDITS)**

**(100 Marks)**

### **Course outcomes:**

On successful completion of this course, student will be able to:

- Describe microbial diversity, microbial taxonomy and systematics and explain the processes used for replication, adaptations and interaction with the host and environment.
- To learn and get introduced to some rapidly evolving fields, including genome editing techniques and regulation of gene expression by different types of RNAs
- Understand basics and applications of various assisted reproductive technology such as artificial insemination, embryo transfer, in vitro fertilization and transgenic animal technology
- Explain the structural and functional relationships of various organelles such as mitochondria, chloroplast, ER, Golgi complex, lysosome with detailed understanding of protein sorting and vesicular trafficking;
- Describe fundamental molecular principles of genetics.

### **Unit-I: Tools & Techniques in Biotechnology & Microbiology**

Basics of Microscopy (Light, Phase-Contrast, Fluorescence), Electron Microscope (SEM and TEM), FACS, Spectrophotometry (UV-VIS, Fluorescence, IR Spectroscopy), Mass spectrometry and MALDI-TOF, Chromatographic Techniques (Gel exclusion, Ion Exchange, Affinity, HPLC, FPLC), NMR, Circular Dichroism, Electrophoresis (Agarose, PAGE, IEF, 2DE-DIGE), PCR and Blotting Techniques.

Sterilization and Aseptic Techniques, Media Preparation for microbial cultures, Culture and Identification of Microbes; Microbial diagnostics: Bacteriology: Staining procedures in clinical Microbiology, Typing methods: Biotyping, Antibigram typing, Phage typing. Nucleic acid based typing: PCR typings, Robotizing, WGS typing. Virology: Sampling, Cell culture, Serotyping, Diagnostic assay: Cytopathic effect test.

### **Unit-II: Plant and Animal Tissue Culture Technology**

Biotechnology in crop improvement: micro propagation, callus culture, cell suspension culture, soma clonal variation, Biotechnology of secondary metabolites. Equipments and materials for animal cell culture, Animal cell culture techniques- Role of serum and specific media formulations, Primary culture and its maintenance: Various techniques of tissue disaggregation, Monolayer, suspension and 3D culture, establishment of cell lines, Characterization of cells, Transformation and Cryopreservation.



### **Unit-III: Functional Genomics & Genetic Engineering**

Molecular Mapping of Genome- Genetic and physical mapping; Molecular markers in genome analysis; Global gene expression strategies; Next-generation sequencing strategies. Genetic engineering of plants & animals; modern methods of foreign DNA delivery; marker genes and marker free transgenic systems; cDNA library, cloning interactions and hybrid systems; Gene silencing & its applications

### **Unit-IV: Basics of Environmental Biotechnology**

Biofertilizers: Symbiotic free nitrogen fixers, asymbiotic free nitrogen fixers, algal, phosphate solubilizing, mycorrhizae and green manure. Microbial sources of pharmaceutically important compounds. Bioremediation: in situ and ex situ bioremediation, constrains and priorities of bioremediation, Evaluating Bioremediation, Bioremediation of VOCs; Biodegradation: Factors affecting on process of biodegradation. Methods in determining biodegradability. Contaminant availability for biodegradation; Phytoremediation technology: methods, advantages and disadvantages, Bioleaching, Biosorption phytomining; Sources of heavy metal pollution.

### **Suggested Readings:**

1. Textbook of environmental biotechnology: Pradipta Kumar Mohapatra. 2nd edition. IKinternational publishers.
2. Introduction to Environmental Biotechnology: A.K. Chatterji. PHI publishers.
3. Environmental Biotechnology: A Text Book for University Student- SVS Rana.Rastogi Publications, 2009
4. Biotechnology in crop improvement. H. S. Chawla.
5. Biotechnology and Genomics, P. K. Gupta, Rastogi publications.
6. Molecular Cloning: A laboratory manual by J. Sambrook and E.F. Fritsch.
7. Genomes by T.A. Brown
8. Molecular biology of the gene by J.D. Watson, T.A. Baker, S.P. Bell, A. Gann, M.Levine and R. Losick.
9. Brock Biology of microorganisms: Madigan, Martinko, Dunlap, Clark. 12<sup>th</sup> edition Pearson International edition.
10. Willey JM, Sherwood LM, and Woolverton CJ (2008) Prescott, Harley and Klein's Microbiology. 7<sup>th</sup> edition. McGraw Hill Higher Education.
11. Ian Feshney, Basics of Animal Cell Culture.

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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	5	4	2	5	5	5	4	5	5	5
CO2	4	2	4	5	4	2	5	4	2	5
CO3	4	4	4	5	4	2	5	4	2	5
CO4	5	5	5	5	5	4	5	5	4	5
CO5	5	5	5	5	5	4	5	5	4	5

### PAPER 3: REVIEW OF RELATED LITERATURE

**(2 CREDITS)**

**(50 Marks)**

Each student is required to select a problem on which she has to do intensive review of related studies under the supervision of a faculty member or the supervisor. She has to review adequate research studies related to the problem and prepare a report.

Each student is required to present the review of related studies through Power-Point. All the Ph.D. and P.G. students of the Department shall remain present and participate in the discussion. There will be an open viva-voce test after the presentation. Assessment shall be made on the basis the following criteria:

- 1) Relevance of the reviews.
- 2) Finding the research gap.
- 3) Standard and quality of writing the review.
- 4) Style of presentation.
- 5) Answering the question by Examiners
- 6) Clarification of queries raised by the participants.

#### **DISTRIBUTION OF MARKS (Total: 50 Marks)**

- 1) Report submission : 20 Marks
- 2) Presentation : 20 Marks
- 3) Viva-voce Test : 10 Marks

## **PAPER 4: RESEARCH & PUBLICATION ETHICS**

**(2 CREDITS)**

**(50 Marks)**

### **Course outcome**

On successful completion of this course, student will be able to:

- Gain knowledge on different ethical philosophies
- Able to apply the ethics and scientific conduct in relation to research and publication.
- Adapt best standard practices in research
- Get information on consequences of violating publication ethics
- Able to identify predatory journals and publishers

### **THEORY**

#### **Unit-IA: Philosophy and Ethics (3 hrs)**

Introduction to Philosophy: definition, nature and scope, concept, branches; Ethics: definition, moral philosophy, nature of moral judgment and reactions.

#### **Unit-IB: Scientific Conduct (5 hrs)**

Ethics with respect to science and research; Intellectual honesty and research integrity; Scientific misconduct: Falsification, Fabrication, and Plagiarism (FFP); Redundant Publications: duplicate and overlapping publications; Selective reporting and misrepresentation of data.

#### **Unit-IC: Publication Ethics (7 hrs)**

Publication ethics: definition, introduction and importance; Best practices/standards setting initiatives and guidelines: COPE, WAME etc.; Conflict of interest; Publication misconduct: definition, concept, problems that lead to unethical behaviour, types; Violation of publication ethics, authorship and contributorship; Identification of publication misconduct, complaints and appeals; Predatory publishers and journals

### **PRACTICE**

#### **Unit-IIA: Open Access Publishing (4 hrs)**

Open Access Publications and initiatives; Online resource to check publisher copyright and self-achieving policies (SHERPA/RoMEO); Software tool to identify

predatory publications developed by SPPU; Journal finder/journal suggestion tools viz. Elsevier finder, Springer, Journal suggerster etc.

### **Unit-IIB: Publication Misconduct (4 hrs)**

#### **A. Group Discussion**

Subject Specific ethical issues, FFP, authorship; Conflict of interest; Complaints and appeals: examples and fraud from India and abroad

#### **B. Software tools**

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

### **Unit-IIC: Database and Research Metrics (7 hrs)**

#### **A. Databases**

Indexing databases; Citation databases: Web of Science, Scopus. etc.

#### **B. Research Metrics**

Impact Factor of journal as per Journal Citation Report; Metrics: h-index, g-index, i10index, altmetrics.

## **REFERENCES**

1. Bird, A. (2006). Philosophy of science. Rutledge.  
MacIntyre, A. (1967). A short history of ethics. London.
2. P.Chaddah (2018). Ethics in competitive Research: Do not get scooped; do not get plagiarised.National Academy of Sciences (2009). On being a scientist: A guide to responsible conduct in Research (3<sup>rd</sup> Ed.), National Academics Press.
3. Resnik, D.B. (2011). What is ethics in research & why is it important. National Institute of Environmental Health Sciences, 1-10.
4. Beall, J. (2102). Predatory publishers are corrupting open access. Nature, 489 (7415), 179-179.
5. Indian National Science Academy (INSA). Ethics in science education, research and governance (2019)

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CO1	4	4	2	5	5	5	4	5	5	5
CO2	4	2	4	5	4	2	4	4	2	5
CO3	2	4	4	5	4	2	5	4	2	5
CO4	5	5	4	4	5	4	4	5	4	5
CO5	4	5	5	5	5	4	5	5	4	5