SYLLABUS FOR
Pre Ph.D Course work in BIOTECHNOLOGY
(Effective Form the Session 2022-23)

Berhampur University
Bhanja Bihar-760007
Odisha, India

Course Work For Pre Ph.D Biotechnology

Paper code	Title	Credits	Internal Marks	End sem Marks	Total Marks
ONE SEMESTER BASED COURSE WORK					
PPBIOT-C-101	Bioinstrumentation	4	10	40	50
PPBIOT -C-102	Research Methodology	3	10	40	50
PPBIOT -E-103	Elective*	4	10	40	50
PPBIOT -C-104	IPR, Biosafety and Bioethics	2	10	40	50
PPBIOT -C-105	Research and Publication Ethics	2	10	40	50
PPBIOT -S-106	Review of Research Papers & Seminar	1	--	50	50
	SEMESTER-I TOTAL	**16**	**50**	**250**	**300**

Elective Papers

PPBIOT-E-103* Elective :
(A) Bacterial Genetics and Genomics
(B) Bioprocess Technology
(C) Infectious Diseases and Autoimmune Disorders
(D) Plant Molecular Beeding and Functional Genomics
(E) Cancer and Cell signalling
(F) Biodiversity and Conservation Genetics

PPBIOT-C-101: Bioinstrumentation 04 Credits

Course Objectives

The objectives of this course are to build upon knowledge and skill on various instruments and technologies with specific emphasis on their application various domains and subdomains of Biotechnology. The objectives of this course are to teach basics of the new principles to students so as to appreciate current-day research tool-kit better

Student Learning Outcomes

On completion of this course, students should be able to:

- Gain fundamental knowledge in instruments and emerging technologies used in Biotechnology;
- Understand the of principles and practices of various instruments within the context of each topic .

Unit I **12 lectures**	Principles, instrumentation and applications of Microscopy- light, phase contrast, fluorescent and electron microscopes (transmission and scanning), FACS, AFM. Principles, instrumentation and applications of Scintillation counter, Geiger-Muller counter; Metabolic labeling for the measurement of radioactivity, Autoradiography.
Unit II **10 lectures**	Principles, instrumentation and applications of Colorimeter; Spectrophotometer (UV-VIS, Fluorescence, IR, RAMAN); ESR and NMR spectroscopy; Mass spectroscopy: Tandem MS, MALDI-TOF. Characterization of nucleic acid and protein using MALDI-TOF and MS-MS.
Unit III **12 lectures**	Principles, instrumentation and applications of Chromatography (TLC, GC, Gel exclusion, Ion-exchange, Affinity, GLC, HPLC, Van Deemter equation and FPLC); Characterization of macromolecular structure using Circular Dichorism (CD), Optical Rotary Dichorism (ORD), X-ray crystallography and Bragg's equation.
Unit IV **14 lectures**	Principles, instrumentation and applications of Electrophoresis (Agarose gel, PAGE, 2-DE, DGGE); Principle, operation and application of Polymerase chain reaction (PCR), Variants of PCR; Blotting techniques (Southern blotting, Northern blotting, Western blotting, CHEF); Nucleic acid sequencing and Next Generation Sequencing.
Recommended Textbooks and References	1. Principle and Techniques of Biochemistry and Molecular Biology, by Wilson & Walker. (John-Willey) 2. Molecular Biomethods Hand Book, R Rapley & J. M. Walker (Humana Press). 3. Biochemical Methods by A. Pingoud et al. Willey-VCH, GmBH. 4. Organic Spectroscopy Principles & Applications. Mohan Jag, 2000 (Narosa Publishing House) 5. Analytical Chromatography, by Vergesse James (Pacific Books International 2016)

	6. Physical Principles of Electron Microscopy by R. E. Egerton Springer, 2005)

PPBIOT-C-102: Research Methodology — 03 Credits

Course Objectives

The objectives of this course are to give background on history of science, emphasizing methodologies used to do research, use framework of these methodologies for understanding effective lab practices and scientific communication and appreciate scientific ethics.

Student Learning Outcomes

Students should be able to:

- Understand history and methodologies of scientific research, applying these to recent published papers;
- Understand and practice of statistical tools, computer learnings and biological databases;
- Appreciate scientific ethics through case studies.

Unit I **10 lectures**	Application of statistical concepts/procedures. Data, diagrammatic representation of data, Probability, Measure of Central tendency, Measure of dispersion, Skewness and Kurtosis; Normal distribution: Simple correlation, regression analysis; Sampling: Simple random sampling, Stratified random sampling, Systematic sampling.
Unit II **16 lectures**	Testing of Hypothesis tests, X (Chi-square), F and T-tests: Analysis of variance, covariance, Principal component analysis; Experimental design: completely randomized block design, randomized block design, Latin square design. One-way analysis of variance, Two-way analysis of variance, follow up tests; Non-parametric procedures; Probability Distribution (Normal, Binomial and Poison) The standards of a scientific paper, scientific words, paragraph, writing scientific text, presenting numerical data, constructing scientific figures, sections of research paper, choosing a journal, preparing and submitting a manuscript, responding to editors and Referees.
Unit III **12 lectures**	Windows and/or Linux operating system; Learning software packages: SPSS, Graph Pad Prism, R, CMA, Microsoft-Excel, Endnote.
Unit IV **10 lectures**	Biological databases, protein and nucleic acid sequence databases, bibliographic resources and literature databases, Search algorithms, sequence analysis, Structure prediction of proteins and nucleic acid.
Recommended Textbooks and References	1. Fundamentals of Biostatistics; Eighth Edition; 2016 by Bernard Rosner. 2. Research Methodology: Methods and Techniques, C. R. Kothari. 3. From Research to Manuscripts: A Guide to scientific writing, Katz & M. Jay 4. Bioinformatics - A Student's Companion Authors: Syed Ibrahim, K., Gurusubramanian, G., Zothansanga, Yadav, R.P., Senthil Kumar, N., Pandian, S.K., Borah, P., Mohan, S. Elsevier publications.

	5. Introduction to Bioinformatics- Arthur M. Lesk. Oxford University Press Publishers.

PPBIOT-E-103A: Bacterial Genetics & Genomics — 04 Credits

Course Objectives

The objectives of this course are to introduce the field of bacterial genetics, with special emphasis on the genomics approaches used in the study of bacterial genetics. The course has been designed covering from the classical molecular genetics to the modern high throughput genomics approaches that are now commonplace in the study of bacterial physiology and cell biology.

Student Learning Outcomes

On completion of the course the students should be able to-

- Describe the fundamental principles of microbial genetics.
- Understand the role of bacterial mutants in the creating the maps of the bacterial genome, as well as, the fundamental role played by the auxotrophic mutants in linking the phenotype to genotype in the bacterial system.
- Explain the various genomics approaches including transcriptomics and proteomics, in deciphering the fundamental aspects of bacterial cell biology and genetics.

Unit I **14 lectures**	The bacterial genome architecture; replication of bacterial chromosome and cell division; mutation and DNA repair mechanisms; extrachromosomal genetic elements- plasmid biology; horizontal gene transfer mechanisms- transformation, transduction (generalized and specialized), and conjugation, regulation of gene transfer by conjugation, Hfr strains, natural transformation and competence, molecular basis of natural transformation: competence pathways in Gram positive and Gram negative bacteria.
Unit II **12 lectures**	Genetic recombination- homologous and site-specific recombination mechanisms; integrating conjugative elements (ICEs), integrons, transposons; isolation of spontaneous mutants, auxotrophy, genetic suppressors, construction of genetic mutants, genetic mapping using recombination data, gene fusions and construction of genetic reporters; genetic complementation, analysis of gene expression; *lac* and *trp* operons, TFs, riboswitches, sRNAs.
Unit III **10 lectures**	DNA Sequencing and the annotation of bacterial genomes (whole genome shotgun sequencing and NGS methods); phylogeny, comparative genomics and metagenomics; transcriptomics, proteomics, transcriptional networks; bacterial stress response pathways; bacterial signal transduction pathways; prokaryotic epigenetics and epigenomics.
Unit IV **12 lectures**	Global gene expression analysis- microarray and RNA-seq methods; use of CRISPR-Cas9, transposon sequencing (Tn-seq); SMRT sequencing and the detection of DNA modifications; DNA-protein interaction studies, Chip-seq and the analysis of TF binding; bacterial 2-hybrid and 3-hybrid systems and the analysis of protein-protein interactions; analysis of spatial localization of transcripts and proteins in the bacterial cell using fluorescence microscopy.

Recommended Textbooks and References	1. Snyder and Champness Molecular Genetics of Bacteria, Fifth Edition (2020). Tina M. Henkin and Joseph E. Peters. John Wiley and Sons. 2. Genetics of Bacteria, First Edition (2013). Sheela Shrivastava. Springer. 3. Molecular genetics of Bacteria, 5th edition (2010). Jeremy MD, Simon PP. John Wiley. 4. Bacterial Genetics and Genomics, 1st Edition (2020). Lory Snyder. CRC Press.

PPBIOT-E-103B: Bioprocess Technology — 04 Credits

Course Objectives

The objectives of this course are to educate students about the fundamental concepts of bioprocess technology and its related applications, thus preparing them to meet the challenges of the new and emerging areas of biotechnology industry.

Student Learning Outcomes

Students should be able to:

- Appreciate relevance of microorganisms from industrial context; Carry out stoichiometric calculations and specify models of their growth;
- Give an account of design and operations of various fermenters; Present unit operations together with the fundamental principles for basic methods in production technique for bio-based products;
- Calculate yield and production rates in a biological production process, and also interpret data; Calculate the need for oxygen and oxygen transfer;
- Critically analyze any bioprocess from market point of view; provide an account of important microbial/enzymatic industrial processes in food and fuel industry

Unit I 8 lectures	Introduction to Bioprocesses Technology: Interaction between biochemical engineering; Microbiology and Biochemistry; fermentation processes. fermentation media formulation; Sterilization; Process parameters: measurement of temperature; pressure and pH; dissolved Oxygen; foam etc. Strain improvement by mutation and screening of improved cultures; random and strategic screening methods; strategies of strain improvement for primary; secondary metabolites.
Unit II 14 lectures	Growth Models & Enzyme kinetics: Cell Growth and Enzyme Kinetics: Cell number and Cell mass calculations, Media design for growth, Continuous and batch fermentation, Microbial growth kinetics, Kinetic models for cell growth, Substrate and product inhibited growth models, Factors affecting microbial growth, Cell and enzyme immobilization, Enzyme kinetics. Unstructured and Structured Models of growth and product formation, Compartment Models, Metabolic Models, Cybernetic Models.
Unit III 12 lectures	Bioreactor Design: Bioreactor construction, construction material; Aeration and agitation systems; Valves and steam traps; Temperature controller, Pressure-control valves; computer applications in fermentation technology;

	specialized bioreactors; membrane bioreactors; tower bioreactors; fluidized bed bioreactors; Immobilized system and packed bed reactors and Photobioreactors.
Unit IV **14 lectures**	Downstream Processing for industrial products: Biomass separation by centrifugation; filtration; flocculation and other methods; Cell disintegration: Physical; chemical and enzymatic methods; Separation of solid and liquid phases; isolation and purification techniques for proteins and other products based on different physico-chemical properties; Principles of bioprocess control; bioprocess automation and application of computers in bioprocessing; recombinant products with representative examples.
Recommended Textbooks and References	1. Principles of fermentation technology- Peter F. Stanbury, Allan Whitaker, Stephen J Hall, Permagon Press, 2nd Edition, 1995. 2. Bioprocess Engineering Principles- Pauline M. Doran, Elsevier, 2nd Edition 2013. 3. Fundamentals of Biochemical Engineering- Rajiv Dutta 4. Introduction to Biochemical Engineering- D. G. Rao, Tata Mc Grow Hill

PPBIOT-E-103C: Infectious Diseases and Autoimmune Disorders 04 Credits

Course Objectives

The objectives of this course is to understand the epidemiology and pathogenesis of various infectious diseases with special reference to those prevalent in Indian Population. Furthermore, the course will educate predoctoral students on the importance of autoimmunity and various related disorders that are on the rise in the developing countries

Student Learning Outcomes

Students should be able to understand the fundamentals and importance of infectious diseases and autoimmune disorders in the Indian Population upon completion of this course.

Unit I **10 lectures**	Introduction to infectious diseases and epidemiology, Surveillance of infectious diseases, types of infections: bacterial, viral, fungal, helminthic, protozoan.
Unit II **14 lectures**	Introduction, epidemiology, pathogenesis, symptoms, pathology and diagnosis of Tuberculosis, malaria, Influenza, filariasis, Viral hepatitis, leishmaniasis, COVID-19, HIV, Food and water-borne diseases, Vector-borne diseases, Zoonotic diseases – Anthrax, Rabies and Japanese Encephalitis, Nosocomial or hospital acquired infections.
Unit III **12 lectures**	Innate and adaptive immune system, autoimmunity, immunological tolerance, types of autoimmune diseases; mechanism and role of CD4+ T cells; MHC and TCR in autoimmunity. immunodeficiency: primary immunodeficiencies, acquired or secondary immunodeficiencies, anaphylactic shock.
Unit IV	Introduction, epidemiology, pathogenesis, and pathology of Systemic lupus

12 lectures	Erythematosus, Rheumatoid arthritis, systemic sclerosis, spondylarthritis. Immunogenetics of autoimmune disorders, Genome wide association study of rheumatoid arthritis, type1 diabetes, systemic lupus erythematosus, multiple sclerosis, inflammatory bowel disease. Treatment of autoimmune diseases: established therapies, biologic agents, and other emerging molecular methods.
Recommended Textbooks and References	1. Kuby Immunology; Eighth Edition 2018 by Jenni Punt, Sharon Stranford, Patricia Jones and Judith A Owen. 2. The Autoimmune Diseases 6th Edition, 2020 by N. R. Rose & I .R. Mackayby Academic Press. 3. Essentials of Clinical Infectious Diseases, Second Edition, 2018. by William F. Wright, Springer 4. Infectious Diseases, 3rd Edition, **Authors:** Jonathan Cohen William Powderly Steven Opal, Elsevier

PPBIOT-E-103D: Plant Molecular Breeding & Functional Genomics 04 Credits

Course Objectives

The objectives of this course are to introduce students to the principles, practices and application of DNA markers, Genome sequencing, Sequence analysis, functional genomics, and Molecular breeding of plants.

Student Learning Outcomes

Students should be able to gain fundamental knowledge in principle and practices on the DNA markers, Genome sequence analysis and genomics, marker aided breeding and their applications in the post genomic era.

Unit I 14 lectures	Molecular markers & Mapping: Concept molecular markers; Kinds of molecular markers (RFLP, RAPD, AFLP, SSR, SCAR, STS, EST, SNP) and their development for molecular dissection of plant genome. Molecular mapping of plant genome- mapping population, Constructing molecular maps; Molecular tagging and mapping of oligogenes; QTL mapping; Association Mapping Comparative mapping and synteny map; Concept of epigenome, epialleles and their mapping in plant systems.
Unit II 10 lectures	Plant Genome sequencing: Rationale of sequencing the genome, Genome sequencing- principles, methodology and strategies; Genome sequencing projects in plants; Curation draft sequence of genome; Recognition of coding and non-coding sequences and gene annotation; Tools of gene cataloguing and gene structure prediction; High throughput cloning of ORFs; Allele mining from sequence data (Genome and Transcriptome).
Unit III 12 lectures	Molecular Breeding: Concept and strategies of marker Assisted Selection (MAS), MAS of qualitative and quantitative traits; Physical mapping of gene; Map based cloning of gene and QTL; Genomic based selection (GBS)-Strategies and Application; Case study of MAS and GBS in model plants.
Unit IV	Functional genomics: Identification of candidate genes using positional

12 lectures	cloning, microarray analysis, transcriptome analysis (EST, SAGE), proteome comparison and metabolome profiling; Characterization and functional analysis of candidate genes: TILLING, Eco-TILLING, Reverse genetics, Gene knockout systems and Heterologous expression systems. Case study of functional genomics in model plants.
Recommended Textbooks and References	1. The Hand Book of Plant Genome Mapping: Genetic and Physical mapping By K. Meksem and G. Kahl (Willey- VcH Verlag, GMBH) 2. Principle and Practices of Plant genomics Vol-I & II By Kole. C. and Abbot. G. (CCRS Press). 3. Plant Biotechnology. H.S. Chawla (Oxford IBH) 4. Functional Plant Genomics- Morot Gaudry JF et al (Taylor & Francis). 5. Plant Functional Genomics- D. Leister (CRC Press)

PPBIOT-E-103E : Cancer and Cell Signaling — 04 Credits

Course Objectives

The objectives of this course are to introduce students to the principles of cell signaling, gain knowledge of cancer types, cancer immunology and cancer therapy.

Student Learning Outcomes

Upon completion of this course, the students should be able to:

- Gain fundamental knowledge of signal transduction process.
- Understand the basics of cancer biology and therapy strategies.

Unit I 10 lectures	General principles of signal transduction; signals and sensors, secondary messengers and protein modifications, neurotransmitters, signaling pathways; G protein coupled receptor signalling, Receptor and non-receptor tyrosine kinases, Ser/Thr kinase coupled receptor, Mitogen-Activated Protein Kinases (MAPK), phospholipid mediated signaling, Cytoplasmic receptor, Nuclear receptors.
Unit II 14 lectures	Signaling processes; gene transcription and regulation, Cell cycle and proliferation, Protein translation and non-coding RNAs proteolysis and protein degradation pathways, Cell death signaling, Sensing and communication in bacteria, DNA damage response and repair, Metabolism and signaling, Growth factors steroid hormones and their receptors, Signal transduction in health and disease, Signal transduction in plants.
Unit III 12 lectures	Cancer types, causes and classification, Cancer Biomarkers, Mutations and cancer; Cell cycle and cancer, Apoptosis and cancer, Regulation of Oncogene and Tumour suppressor genes**:** Myc, Ras, Raf, Rb, P53 pathways.

Unit IV **12 lectures**	Cancer Immunology and therapy: Viruses & Bacterial pathogens and cancer; Therapeutic vaccines, Cancer therapy, SMI, Radio immune targeting, chemoprevention strategies, Progression of oral cancer and Breast cancer.
Recommended Textbooks and References	1. Molecular Biology of the Cell. Sixth Edition 2014. Garland Science. Bruce Alberts and Alexander Johnson. 2. Cellular Signaling Processing. An introduction to the molecular mechanism of signal transduction. Garland Science. Friedrich Marks, Ursula Klingmuller and Karin Muller-Decker 3. Biochemistry of Signal Transduction and Regulation. First Edition. 2014. Wiley-VCH. Gerhard Krauss. 4. Molecular Biology of Cancer. Fourth Edition. 2014. Oxford. Pecorino Lauren 5. Oxford Textbook of Cancer Biology 2020 Oxford. Pezzella et al.

PPBIOT-E-103F: Biodiversity and Conservation Genetics 04 Credits

Course Objectives

The objectives of this course are to build upon postgraduate level knowledge of biodiversity and conservation. The course shall make the students aware of various biotechnological approaches used to assess and manage biodiversity.

Student Learning Outcomes

On completion of this course, students should be able to:

- Gain fundamental knowledge in biodiversity including genetic & metabolic diversityand their conservation;
- Understand various biotechnological approaches used to assess genetic and metabolic diversity;
- Understand the management of biodiversity.

Unit I **12 lectures**	Introduction to Biodiversity: Definition, components, scope, and constraints of biodiversity (genetic diversity, species diversity, ecosystem diversity - agro-biodiversity, urban - peri-urban biodiversity), forest biodiversity; Metabolic Diversity; Biodiversity indices; Threats to biodiversity; Biodiversity hotspots in the world, National and global red data lists, Categories of species and their management; Importance of biodiversity; Conservation of biodiversity, in-situ and ex-situ conservation.
Unit II **10 lectures**	Genetic and Metabolic Diversity: Genetic Variation: Definition and importance of genetic variation. Understanding population genetics: Measuring genetic diversity: The Hardy-Weinberg law; Genetically effective populations size, Gene flow-Genetic pollution and Gene erosion. Evolutionary forces for genetic variation. Plant metabolites: Introduction, Importance of plant metabolites; Plant metabolic diversity; Phytopharmaceuticals and their source herbs.

Unit III **14 lectures**	Biotechnological Approaches to assess Genetic and Metabolic Diversity: Introduction to Molecular Markers: Allozyme, Randomly Amplified Polymorphic DNA (RAPD), Restriction Fragment Length Polymorphism (RFLP), Amplified Fragment Length Polymorphism (AFLP), Single Sequence Repeats (SSR), DNA fingerprinting, Single Nucleotide Polymorphism (SNP); Cryopreservation. Introduction to plant metabolites; Methods for Preparation of Extracts; Types of herbal extracts; Different methods of extraction; Quantitative analysis of Crude Drug Extracts and Isolates. Assessment of metabolic diversity through bioanalytical approaches.
Unit IV **12 lectures**	Conservation Genetics and Biodiversity Management: Use of genetic information in identification and prioritization of groups or populations for designing and implementation of conservation strategies in plants; Understanding different levels of population exploitation on genetic and metabolic diversity; Biodiversity prospecting; IPR of biodiversity and its products; Patent protection and biopiracy; Biodiversity informatics, Databases in biological materials.
Recommended Textbooks and References	1. Essentials of Conservation Biology-Primack, R., Sinauer assoc., Inc., USA 2. ConservationBiology-Pullin,A.S., Cambridge University Press, Cambridge. 3. Biodiversity : Principles & Conservation- Kumar,U. ,Asija, M.J., Agrobios India-Jhodhpur. 4. Gardner, E. J. 1975. Principles of Genetics.John Wiley and Sons. 5. Groom, M. J., Meffe, G. R. and C. R. Carroll. 2006. Principles of conservation biology. Sinauer associates, Inc., USA. 6. Hamilton, M. 2009. Population Genetics. Wiley-Blackwell Publications, USA. 7. Hedrick, P. W. 1999. Genetics of Population. Jones and Bartlet Publishers, Inc., London. 8. Herbal Drug Technology by S. S. Agrawal and M. Paridhavi, 2013. Orient Blackswan 9. Pandit, M. W., Shivaji, S and Singh, L.2007. You deserve, We Conserve-A Biotechnological Approach to Wild Life Conservation. I.K.International Publishing House Pvt.Ltd. New Delhi. 10. Glick, B. R. and J. J. Pasternak. 2003. Molecular Biotechnology: Principles and Application of Recombinant DNA. ASM Press, Washington, D.C.

PPBIOT-C-104: IPR, Biosafety and Bioethics — 02 Credits

Course Objectives

The objectives of this course are:

- To provide basic knowledge on intellectual property rights and their implications in biological research and product development;
- To become familiar with India's IPR Policy;
- To learn biosafety and risk assessment of products derived from biotechnology and regulation of such products;
- To become familiar with ethical issues in biological research. This course will focus on

Student Learning Outcomes

On completion of this course, students should be able to:

- Understand the rationale for and against IPR and especially patents;
- Understand why India has adopted an IPR Policy and be familiar with broad outline of patent regulations;
- Understand different types of intellectual property rights in general and protection of products derived from biotechnology research and issues related to application and obtaining patents;

consequences of biomedical research technologies such as cloning of whole organisms, genetic modifications, DNA testing.

- Gain knowledge of biosafety and risk assessment of products derived from recombinant DNA research and environmental release of genetically modified organisms, national and international regulations;
- Understand ethical aspects related to biological, biomedical, health care and biotechnology research.

Unit I **5 lectures**	Introduction to intellectual property; Types of IP: patents, trademarks, copyright & related rights, industrial design, traditional knowledge, geographical indications, protection of new GMOs; IPs of relevance to biotechnology and few case studies; GATT, WTO, WIPO and TRIPS; Plant variety protection and farmers rights act; Concept of 'prior art': invention in context of "prior art"; patent databases.
Unit II **5 lectures**	Patents and its types; Indian Patent Act 1970 and recent amendments; WIPO Treaties; Budapest Treaty; Patent Cooperation Treaty (PCT) and implications; Procedure for filing a PCT application and obtaining patents license; financial assistance for patenting-introduction to existing schemes; publication of patents; patent infringement- meaning, scope, litigation, case studies; commercialization of patented innovations; licensing – outright sale, licensing, royalty; patenting by research students and scientists-university/organizational rules in India and abroad.
Unit III **9 lectures**	Biosafety and Biosecurity - introduction to biological safety cabinets; primary containment for biohazards; biosafety levels; GRAS organisms, biosafety levels of specific microorganisms; recommended biosafety levels for infectious agents and infected animals; definition of GMOs & LMOs; principles of safety assessment of transgenic plants – sequential steps in risk assessment; concepts of familiarity and substantial equivalence; risk – environmental risk assessment and food and feed safety assessment; problem formulation – protection goals, compilation of relevant information, risk characterization and development of analysis plan; risk assessment of transgenic crops vs cisgenic plants or products derived from RNAi, genome editing tools. International regulations – Cartagena protocol, OECD consensus documents and Codex Alimentarius; Indian regulations – EPA act and rules, guidance documents, regulatory framework – RCGM, GEAC, IBSC and other regulatory bodies; Draft bill of Biotechnology Regulatory authority of India - containments – biosafety levels and category of rDNA experiments; field trails – biosafety research trials – standard operating procedures - guidelines of state governments; GM labeling – Food Safety and Standards Authority of India (FSSAI).
Unit IV **5 lectures**	Introduction, ethical conflicts in biological sciences - interference with nature, bioethics in health care - patient confidentiality, informed consent, euthanasia, artificial reproductive technologies, prenatal diagnosis, genetic screening, gene therapy, transplantation. Bioethics in research – cloning and stem cell research, Human and animal experimentation, animal rights/welfare, Agricultural biotechnology - Genetically engineered food, environmental risk, labeling and public opinion. Sharing benefits and protecting future generations - Protection of environment and biodiversity – biopiracy.

Recommended Textbooks and References	1. Ganguli, P. (2001). Intellectual Property Rights: Unleashing the Knowledge Economy. New Delhi: Tata McGraw-Hill Pub. 2. National IPR Policy, Department of Industrial Policy & Promotion, Ministry of Commerce, GoI 3. Complete Reference to Intellectual Property Rights Laws. (2007). Snow White Publication Oct. 4. Kuhse, H. (2010). Bioethics: an Anthology. Malden, MA: Blackwell. 5. Office of the Controller General of Patents, Design & Trademarks; Department of Industrial Policy & Promotion; Ministry of Commerce & Industry; Government of India. http://www.ipindia.nic.in/ 6. Karen F. Greif and Jon F. Merz, Current Controversies in the Biological Sciences -Case Studies of Policy Challenges from New Technologies, MIT Press 7. World Trade Organisation. http://www.wto.org 8. World Intellectual Property Organisation. http://www.wipo.int 9. International Union for the Protection of New Varieties of Plants. http://www.upov.int 10. National Portal of India. http://www.archive.india.gov.in 11. National Biodiversity Authority. http://www.nbaindia.org 12. Recombinant DNA Safety Guidelines, 1990 Department of Biotechnology, Ministry of Science and Technology, Govt. of India. Retrieved from http://www.envfor.nic.in/ divisions/csurv/geac/annex-5.pdf

PPBIOT-C-105: Research & Publication Ethics — 02 Credits

Course Objectives

The objectives of this course are:

- To provide knowledge on basic philosophy of Science and ethics, research integrity and publication ethics.
- To become familiar with research mis conduct, predatory publications, Research Metrices, Indexing and citation databases.

Student Learning Outcomes

On completion of this course, students should be able to:

- Understand the rationale for research integrity and publication ethics;
- Understand why India has adopted a Policy for publication ethics, research misconduct and predatory publications;
- Understand different types of research metrices, indexing and citation data bases.

Unit I 8 lectures	**PUBLICATIONS & ETHICS** Introduction to Philosophy: Definition, Nature and scope; Concept and branches; Ethics: Definition, Moral Philosophy, Nature of Moral Judgements and reactions. **SCIENTIFIC CONDUCTS** Ethics with respect to Science and research; Intellectual honesty and Research integrity; Scientific Misconducts: Falsifications, Fabrications and plagiarism (FFP); Redundant Publications: Duplicate and Overlapping Publication, Salami

	Slicing; Selective reporting and misrepresentation of Data
Unit II **7 lectures**	**PUBLICATION ETHICS** Publication ethics: definition, introduction and importance; Best practices/ standards setting initiatives and guidelines: COPE, WAME, etc.; Conflicts of interest; Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types; Violation of publication ethics, authorship and contributor ship; Identification of publication misconduct, complaints and appeals ; Predatory publishers and journals
Unit III **8 lectures**	**OPEN ACCESS PUBLISHING** Open access publications and initiatives; SHERPA/RoMEO online resourse to check publisher copyright and self-archiving policies; Software tools to identify predatory publications developed by SPPU; Journal finder/ journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc. **PUBLICATION MISCONDUCT** **A. Group Discussions (2 hrs):** 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 (2 hrs):** Use of plagiarism software like Turnitin, Urkund and other open source software tools.
Unit IV **7 lectures**	**DATABASES AND RESEARCH METRICS** **A. Databases** 1. Indexing databases; 2. Citation databases: Web of Science, Scopus, etc. **B. Research Metrics (3 hrs)** 1. Impact Factor of journal as per journal citation report, SNIP, SJR, IPP, Cite Score; 2. Metrics: h-index, g index, i10 index, altmetrics
Recommended Textbooks and References	1. Bird, A. (2006). Philosophy of Science. Routledge. 2. MacIntyre, Alasdair (1967). A Short History of Ethics. London. 3. Chaddah, P. (2018). Ethics in Competitive Research: Do not get Scooped; do not get Plagiarized. ISBN: 978-938748086 4. National Academy of Sciences, National Academy of Engineering and Institute of Medicine (2009). On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition. National Academies Press. 5. Resnik, D.B. (2011). *What is Ethics in Research & Why is it Important.* National Institute of Environmental Health Sciences, 10. Retrieved from https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm 6. Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179-179. https://doi.org/10.1038/489179a 7. Indian National Science Academy (INSA) (2019). Ethics in Science Education, Research and Governance. ISBN: 978-81-939482-1-7. http://www.insaindia.res.in/pdf/Ethics_Book.pdf