BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI – 620 024.

M.Phil. BIOTECHNOLOGY (FT / PT) PROGRAMME

(For the candidates to be admitted from the academic year 2018-19 onwards)

Eligibility : M.Sc., Biotechnology

PROGRAMME OBJECTIVES :

- To prepare students for successful career in industry and research institutes.
- To develop the ability amongst the students to apply modern biotechnological techniques in industry and research.
- To enable students to work in a team with multidisciplinary approach.
- To provide students with fundamental strength in analyzing, designing and solving research and industry related problems.
- To promote and inculcate ethics and code of professional practice among students.

PROGRAMME STRUCTURE

Sem-ester	Course	Title of the Course	Exam. Hours	Credits	Marks		
					IA	UE	Total
I	Course - I	Research Methodology	3	4	25	75	100
	Course - II	Applied Biotechnology	3	4	25	75	100
	Course – III	Teaching and Learning skills (Common Paper)	3	4	25	75	100
	Course - IV	Paper on Topic of Research (The syllabus will be prepared by the Guide and the examination will be conducted by the COE)	3	4	25	75	100
II	---	Dissertation and Viva-Voce Viva Voce 50 marks Dissertation 150 marks	--	8	--	--	200
Total				**24**	**--**	**--**	**600**

PROGRAMME OUTCOMES :

- After successful completion of Master of Philosophy in Biotechnology, the students will be able to demonstrate basic knowledge in biological sciences.
- The students would acquire basic knowledge of research and skills to design and conduct experiments, analyze data and interpret the results.
- The students will be able to demonstrate understanding of basic knowledge in modern biotechnology disciplines.
- The students will be able to demonstrate understanding of modern techniques used in biotechnology.
- The students will be able to acquire knowledge to apply biotechnical solutions in various industries.
- The student will be able to demonstrate ability to provide technological solutions in the fields of modern biotechnological applications.
- The students will be able to reinforce research skills and high end recent advances in biotechnology.
- The students will be able to communicate effectively and demonstrate professional and ethical responsibilities.
- The graduates will acquire first-hand experience in working on projects at individual level and exposure to industrial and research environment.

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COURSE I

RESEARCH METHODOLOGY

Course Objectives :

Specifically, the course aims to equip the students with the basic concepts used in research and to scientific social research methods, to known about the instrumentation in the field of biotechnology, to expertise students in the techniques of rDNA technology, to understand the various analytical techniques used in biotechnology based research and industry, to familiarize students with basic concepts of sequences, structural alignment, database searching and also provide understanding of the fundamentals of statistics, methodology and theory of statistics.

Unit I

Selection of research problem, experimental approach, research design, sources of information, literature review, technical papers, peer reviewed journals, e-journals, citation index, impact factor, h-index, reference collection from internet, index card arrangement and research documentation. Thesis writing - components of thesis, preparation of research documents (abstracts, papers etc). Planning of research: Research proposals and time scheduling of research.

Unit II

pH meter – principle, types, operation and applications. Buffers – types and preparations. Centrifugation – principle, operation, types and applications. Microscope – principle, operation, types and applications of electron microscopy (TEM & SEM), fluorescence, confocal and flow cytometry. Different types of fixation and staining techniques.

Unit III

Chromatography **–** principle, operations and applications – paper, TLC, HPTLC, GC, GC-MS, HPLC, column, ion exchange and affinity chromatography. Electrophoresis **–** principle, operation and applications – AGE, PAGE, capillary, immune electrophoresis and isoelectric focusing. Spectroscopy – spectrophotometer, UV visible spectrophotometer, flame photometer, atomic adsorbtion spectrophotometer, fluorimeter, NMR, FT-IR and ESR. Different types of mass spectrometry and surface plasma resonance methods.

Unit IV

Introduction to genetic engineering and recombinant DNA technology. Enzymes used in rDNA technology, different types of vectors – plasmids, phage vector, cosmids, phagemids, viral vector, shuttle vector and expression vectors – YAC, BAC, MAC, PAC, - *S.cerevisiae* system as model. Cloning strategies – construction of genomic library, cDNA library and its applications. Principle, operation, applications and variants of PCR, RFLP, RAPD, microsatellite marker, DNA finger printing and blotting techniques. Next generation DNA sequencing methods.

Unit V

Principles and practice of statistical methods in biotechnological research; collection, tabulation, graphical and diagrammatical representation of data; simple correlation and regression analysis, Chi-square test, student t-test, ANOVA and duncan multiple range test. Principle and applications of discriminate functional analysis (DFA) and cluster analysis. Bioinformatics – nucleic acid and protein data bases, sequence analysis and structural visualization softwares. Data base searching methods; protein structure predictions. RNA structural analysis, plasmid mapping and primer designing. Prediction of genes, promoters and regulatory regions. Genome comparison and phylogeny analysis.

REFERENCES:

1. Subhojit Banerjee, and Ramend Roy. "Fundamentals of Research methodology". 2017. Kitab Mahal publications, Allahabad, India.
2. Veerakumari L. "Bioinstrumentation". 2015. MJP publishers, Chennai, India.
3. Gurumani N. "An Introduction to Biostatistics". 2015. MJP publishers, Chennai, India.
4. Ajaz Ahmad Waza and Mahboob Ul Hussain. "Biotechnology Lab Manual". 2015. Black prints, Ghaziabad, India.
5. Monika Jain. "Recombinant DNA Techniques". 2014. Narosa publications. New Delhi, India.
6. George M. Malacinski. "Freifeder's Essentials of Molecular Biology". 2013. Norosa Publishing House.
7. David W. Mount. "Bioinformatics: sequence and genome analysis" 2nd edition. 2004. CSHL press.
8. Attwood TK and Parry Smith DJ. Introduction to Bioinformatics. 2002. Pearson education singapore.
9. https://explorable.com/research-methodology
10. https://www.docsity.com/en/study-notes/subjects/research-methodology/
11. https://lecturenotes.in/subject/27/biomedical-instrumentation-bi

Course Outcomes :

Students will be able to

- Identify and justify the basic components of the research framework, relevant to the tackled research problem.
- Apply basic principles of different analytical techniques in analytical work.
- use spectroscopy, electron microscopes and radioactivity in biotechnological applications.
- Apply landmark discoveries in developing a number of facile molecular techniques used in rDNA technology.
- Analyze sequence and structure of bio-macromolecule data.
- Classify various types of data and apply basic statistical concepts such as measures of central tendencies, measures of dispersion and sampling.

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COURSE II

APPLIED BIOTECHNOLOGY

Course Objectives :

The course is aimed to acquire knowledge on various recombinant DNA techniques to produce GMOs with novel traits, to understand the maintenance of animal cell lines and to understand the principles of animal cloning and its applications, to provide a comprehensive understanding of bioprocess technology and its role in manufacturing bioproducts, to acquainted with the fundamental concepts of nanotechnology and its principles in modern biotechnology applications and to understand balanced integration of scientific and social knowledge in sustainable development.

UNIT I : Plant Biotechnology

Micropropagation- Callus induction- Meristem tip culture, somatic embryogenesis- embryo rescue- protoplast culture- somaclonal variations, selectable markers and reporter genes. Molecular biology of agrobacterium mediated DNA transfer- Ti plasmid and Ri plasmid vectors- biolistics- electroporation. Transgenic plant production and identification methods. Genetic engineering for biotic and abiotic stress, flower pigmentation, delayed fruit ripening, artificial seeds and terminator seed technology. Gene silencing: Anti-sense RNA technology and RNA interference. Production technology for plantigens, plantibodies and food vaccines.

UNIT II : Animal Biotechnology

Animal cell cultures – primary & continuous cell lines. Animal virus derived vectors: SV-40 and baculovirus. Expression vectors - GST and pET-based vectors; methods for transgenic animal production, transgenic mice, fish and sheep. Transgenic disease models. Hybridoma technology - Gene therapy, stem cell technology, somatic cell, nuclear transfer and Xeno-transplantation. Production of recombinant products – vaccines, growth hormones and human interferons.

UNIT III : Bioprocess Technology

Scope and techniques of Bioprocess - Selection and strains improvement in biomass production, production of recombinant proteins, enzymes and vaccines in microbes. Bioprospecting of microbial diversity and metagenomics. Site directed mutagenesis and protein engineering. Production of novel metabolites by microbes. Uses of genetically engineered microbes in agriculture, industries and medicine.

UNIT IV : Nanobiotechnology

Nanoparticle synthesis and characterization. Bionano particles - nanostarch, nanoparticulate, nanocomposites, nanobiosensors. Dentrimers as nanoparticulates. Nanotechnology in molecular diagnosis. Nanoparticles for biomedical imaging - immuno fluorescent biomarker – immuno gold labeling, iron oxide nanoparticles for magnetic resonance imaging (MRI). Applications of nanobiotechnology – Biochips, nucleic acid nanoparticles: nanotubes and nanorods. Fullerenes for drug delivery. Nanotechnology in drug discovery and delivery. Applications of nanomaterials in medicine. Ethical considerations of nanobiotechnology.

UNIT V : Biosafety

Biosafety – Biosafety for human health and environment. Biosafety levels and containment principles. Social and ethical issues of biosafety. Biosafety principles for GMOs. Bioweapons and bioshields. Bioethics – ethics of using biotechnology in medical science and agriculture. Overview of national regulations and relevant international agreements including Cartegana Protocol. Intellectual property rights and patenting (Process and Product).

References:

1. Morris MD. "Molecular Biotechnology". 2016. CBS publishers and distributors, India.
2. Nooralabettu Krishna Prasad. "Down Stream Process Technology". 2016. PHI learning private limited, New Delhi, India.
3. Sanjay Kumar Sharma. "Plant Tissue Culture". 2016. Book enclave, Jaipur, India.
4. Vyas SP and Mehta A. "Cell and Molecular Biology". 2014. CBS publisher & distributors, New Delhi, India.
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6. Sheelendra M Bhatt. "Animal Cell Culture concept and applications". 2013. Narosa publishing house, India.
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9. Adrian Slater, Nigel W. Scott, Mark R. Fowler. "Plant Biotechnology: An Introduction to Genetic Engineering". 2008. Oxford University Press.
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11. https://www.docsity.com/en/subjects/plant-biotechnology/
12. https://biotechnologyall4u.weebly.com/biotechnology-notes.html

Course Learning Outcomes (CLOs):

Students will be able to:

- Learn the techniques and good understanding of r-DNA technology.
- Develop proficiency in establishing and maintaining of animal cell lines and to acquire knowledge in animal cloning and its applications.
- Explain the principles of major operations used in a bioprocess industry.
- Understand the concept of nanotechnology and its interdisciplinary aspects and the importance of nanomaterials for biomedical, therapeutic and environmental applications.
- Interpret basics of biosafety and bioethics and its impact on all the biological sciences and the quality of human life.

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COURSE III

Teaching and Learning Skills

Course Objectives :

- Acquaint different parts of computer system and their functions.
- Understand the operations and use of computers and common Accessories.
- Develop skills of ICT and apply them in teaching learning context and Research.
- Appreciate the role of ICT in teaching, learning and Research.
- Acquire the knowledge of communication skill with special reference to its elements, types, development and styles.
- Understand the terms communication Technology and Computer mediated teaching and develop multimedia /e- content in their respective subject.
- Understand the communication process through the web.
- Acquire the knowledge of Instructional Technology and its Applications.
- Develop different teaching skills for putting the content across to targeted audience.

Unit I : Computer Application Skills

Information and Communication Technology (ICT): Definition, Meaning, Features, Trends – Integration of ICT in teaching and learning – ICT applications: Using word processors, Spread sheets, Power point slides in the classroom – ICT for Research: On-line journals, e-books, Courseware, Tutorials, Technical reports, Theses and Dissertations- **ICT for Professional Development** : Concept of professional development; institutional efforts for competency building; individual learning for professional development using professional networks, OERs, technology for action research, etc.

Unit II : Communications Skills

Communication: Definitions – Elements of Communication: Sender, Message, Channel, Receiver, Feedback and Noise – Types of Communication: Spoken and Written; Non-verbal communication – Intrapersonal, interpersonal, Group and Mass communication – Barriers to communication: Mechanical, Physical, Linguistic & Cultural – Skills of communication: Listening, Speaking, Reading and Writing – Methods of developing fluency in oral and written communication – Style, Diction and Vocabulary – Classroom communication and dynamics.

Unit III : Pedagogy

Instructional Technology: Definition, Objectives and Types – Difference between Teaching and Instruction – Lecture Technique: Steps, Planning of a Lecture, Delivery of a Lecture – Narration in tune with the nature of different disciplines – Lecture with power point presentation - Versatility of Lecture technique – Demonstration: Characteristics, Principles, planning Implementation and Evaluation – Teaching-learning Techniques: Team Teaching, Group discussion, Seminar, Workshop, Symposium and Panel Discussion.

Unit IV : E- Learning, Technology Integration and Academic Resources in India

Concept and types of e-learning (synchronous and asynchronous instructional delivery and means), m-learning (mobile apps); blended learning; flipped learning; E-learning tools (like LMS; software's for word processing, making presentations, online editing, etc.); subject specific tools for e-learning; awareness of e-learning standards- Concept of technology integration in teaching- learning processes; frameworks guiding technology integration (like TPACK; SAMR); Technology Integration Matrix- Academic Resources in India: MOOC, NMEICT; NPTEL; e-pathshala; SWAYAM, SWAYAM Prabha, National academic depository, National Digital Library; e-Sodh Sindhu; virtual labs; eYantra, Talk to a teacher, MOODLE, mobile apps, etc.

Unit V : Skills of Teaching and Technology based assessment

Teaching skills: Definition, Meaning and Nature- Types of Teaching Skills: Skill of Set Induction, Skill of Stimulus Variation, Skill of Explaining, Skill of Probing Questions, Skill of Black Board Writing and Skill of Closure – Integration of Teaching Skills – Evaluation of Teaching Skills- **Technology for Assessment:** Concept of assessment and paradigm shift in assessment; role of technology in assessment 'for' learning; tools for self & peer assessment (recording devices; e-rubrics, etc.); online assessment (open source software's; e-portfolio; quiz makers; e- rubrics; survey tools); technology for assessment of collaborative learning like blogs, discussion forums; learning analytics.

References

1. Bela Rani Sharma (2007), Curriculum Reforms and Teaching Methods, Sarup and sons, New Delhi
2. Brandon Hall , E-learning, A research note by Namahn, found in: www.namahn.com/resources/ .../note-e-learning.pdf, Retrieved on 05/08/2011
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13. Sharma,R.A., (2006) Fundamentals of Educational Technology, Surya Publications, Meerut
14. Vanaja, M and Rajasekar, S (2006), Computer Education, Neelkamal Publications, Hyderabad.

Course Outcomes

After completing the course, the students will:

- Develop skills of ICT and apply them in Teaching Learning context and Research.
- Be able to use ICT for their professional development.
- Leverage OERs for their teaching and research.
- Appreciate the role of ICT in teaching, learning and Research.
- Develop communication skills with special reference to Listening, Speaking, Reading and Writing.
- Learn how to use instructional technology effectively in a classroom.
- Master the preparation and implementation of teaching techniques.
- Develop adequate skills and competencies to organize seminar / conference / workshop / symposium / panel discussion.
- Develop skills in e-learning and technology integration.
- Have the ability to utilize Academic resources in India for their teaching.
- Have the mastery over communication process through the web.
- Develop different teaching skills for putting the content across to targeted audience.
- Have the ability to use technology for assessment in a classroom.

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