# PONDICHERRY UNIVERSITY
# PUDUCHERRY 605 014


**CURRICULUM AND SYLLABUS of**

# Ph.D Microbiology

**(2019 ONWARDS)**

## Department of Microbiology

## School of Life Sciences

## Ph.D. Course for Microbiology, Pondicherry University

### Paper 1. Research Methodology

**Course Code: MICB 601**
**Total Number of Lecture hours: 40**

***Course objective:*** *This course aims to prepare the Ph.D. Microbiology students for their thesis works and reporting.*

**Pre-requisite:** Ph.D. course work students in Life Sciences

**Unit 1** **6 h**

Research: Types, Research process and steps in it, Hypothesis, Research proposals and aspects. Research Design: Need, Problem Definition, variables, research design concepts, Literature survey and review, Research design process, Errors in research. Research Modeling: Types of Models, Model building and stages, Data consideration and testing, Heuristic and Simulation modeling. Report Writing: Pre writing considerations, Thesis writing, Formats of report writing, Formats of publications in Research journals – JCI – Impact factor and H-index. Ethics in science reporting - Reproduction of published material – Plagiarism and acknowledgement.

**Unit 2** **8 h**

Design of Experiments: Objectives, strategies, Factorial experimental design, Designing engineering experiments, basic principles-replication, randomization, blocking, Guidelines for design of experiments. Single Factor Experiment: Hypothesis testing, Analysis of Variance components (ANOVA) for fixed effect model; Total, treatment and error of squares, Degrees of freedom, Confidence interval; ANOVA for random effects model, Estimation of variance components, Model adequacy checking. Two factor Factorial Design, Basic definitions and principles, main effect and interaction, response surface and contour plots, General arrangement for a two-factor factorial design; Models-Effects, means and regression, Hypothesis testing.

**Unit 3** **8 h**

Advanced Techniques in Microbiology: Denaturing Gradient Gel Electrophoresis (DGGE), Terminal Restriction Fragment Length Polymorphism (T-RFLP), Amplified Ribosomal DNA and Restriction Analysis (ARDRA) - NMR, Fluorescence, Atomic Absorption, CD, ORD, Mass, Raman Spectroscopy – PFGE – MALDI-ToF, TEM and SEM. Organism repository, need for deposition at repository centers, IPR issues on filing of patent on organism (do's and don'ts).

**Unit 4** **8 h**

Microbial Sequence analysis. Preparation of ordered cosmid libraries, bacterial artificial chromosomal libraries, shotgun libraries and sequencing, conventional sequencing (Sanger, Maxam and Gilbert Methods), next-generation sequencing methods - Sequence analysis: Computational methods, homology algorithms (BLAST) for proteins and nucleic acids, open reading frames, annotations of genes, conserved protein motifs related structure / function (PROSITE, PFAM, Profile Scan). DNA analyses for repeats (Direct and inverted), palindromes, folding programmes. Use of Internet, public domain databases for nucleic acid and protein sequences (EMBL, GeneBank), database for protein structure (PDB).

**Unit 5** **6 h**

Biosafety levels – IBC – Institutional ethical committees – Good Laboratory Practices and Good Manufacturing Practices – regulations on rDNA products - Commercialization – Copy right – trademark - designs – royalty - Intellectual property rights and patent law – patent laws in India - WTO – Trade Related aspects of Intellectual Property Rights – Patents – conditions for patentability – composition of a patent – patenting of microorganisms.

**Recommended Text Books:**


1. Montgomery, Douglas C. (2007), 5/e, Design and Analysis of Experiments, (Wiley India)
2. Kothari C.R. and Gaurav Garg (2019). Research Methodology- Methods and Techniques. New Age International, New Delhi.


**Suggested Reading:**


1. Krishnaswamy, K.N., Sivakumar, Appa Iyer and Mathiranjan M. (2006), Management Research Methodology; Integration of Principles, Methods and Techniques (Pearson Education, New Delhi)
2. Writing the doctoral dissertation. Barrons Educational series, 2nd edition, Davis, G.B. and C.A. Parker, 1997. pp 160.
3. Authoring a PhD, thesis: how to plan, draft, write and finish a doctoral dissertation, Duncary, P. 2003. Macmillan, pp 256.
4. Biotechnology and safety assessment, John.A.Thomas, 2004. pp.333
5. Biosafety, Traylor, Fredric & Koch, 2002. Michigan sate University pub., USA
6. Contemporary issues in Bioethics, Beauchamp & Leroy, 1999. Wardsworth Pub. Co. Belmont, California
7. Manual of patent practice and procedure. IPR India, 2005. Ministry of commerce and industry, New Delhi, pp.163.

***Course outcome:*** *The students of this course would understand the research ethics, scientific writing, advanced Microbiology techniques, biosafety of pathogen handdling and IPR issues / procedure on research findings.*