

**Syllabus**  
**Course Work-Ph.D programme**  
**Department of Microbiology, University of North Bengal**

<b>Paper</b>	<b>Paper code</b>	<b>Paper Name</b>	<b>Duration</b>	<b>Lectures</b>	<b>Credits</b>	<b>Full Marks</b>
1.	<b>MBCW01</b>	<b>Research Methodology &amp; Design</b>	First 3Months	10	1	25
2.	<b>MBCW 02</b>	<b>Quantitative Methods</b>	First 3Months	20	2	50
3.	<b>MBCW 03</b>	<b>Computer Application</b>	First 3 Months	10	1	25
4.	<b>MBCW 04</b>	<b>Advance Microbiology</b>	Second 3 Months	40	4	100
5.	<b>MBCW 05/CPE-RPE</b>	<b>Research and Publication Ethics (RPE)</b>	Second 3 Months	30	2	50
<b>Total</b>			<b>6 months</b>	<b>110</b>	<b>10</b>	<b>250</b>

**Paper:MBCW-01**

**Research Methodology and Design**

Defining research Basic and applied research;Essential steps in research ;Defining the research problem; Research/Experimental design; Literature citation ;Research report :components format of thesis and dissertation ,Manuscript/Research article,Review,Monographs,Bibliography and References ;Significance of research ; Bioethics in animal experiments,Safe disposal of microbial and other hazardous wastes,Project proposal.

**Paper: MBCW-02**

**Quantitative Methods**

Measures of central tendency and dispersal;Probability distributions-binomial ,poisson and normal;Sampling distribution ;Hypothesis testing-significance testing,T-test,Chi-square test,F-test;ANOVA-one way and two way analyses ; Regression and correlation analyses;Principle component analysis;Discriminant analysis using software.Biohazards,Riskanalysis,Carcinogens,Toxicagents,Biosafetycabinet,Radiation safety ,Chemical safety,Biosafety guidelines and regulation.

**Paper:MBCW-03**

**Computer Application**

Biological databank and sequence analysis,Database searching and BLAST,FASTA,Multiple sequence alignments CLUSTALW,Computing evolution –phylogenetic analysis ,Promoters,Restrictionsites,RNA folding patterns,Proteinmotifs,Domains,Pattern recognition softwares ,Primer design,Concept of molecular cloning ,Molecular docking and Drug design.

**Paper:MBCW-04**

**Advance Microbiology**

Chemolithotrophy and phototrophy,Biological nitrogen fixation,Cellsignaling in Prokaryotes ,Aerobic fermentation ,Respiration ,Bacterial genetics,Development of mutant strains and genetic analysis,Genotypeanalysis,Preservation of important strains,Properties of Phage infected bacterial culture ,Restriction ,Modification and Trangenics. Genome analysis ,Phylogenetic profiling,VNTR,SNTR,SNP,Differential Display ,Analysis of proteomes,Networking,Integrated 2D gel-MS,Purification of proteins,Microarray analysis.

Phase contrast microscopy ;Confocal microscopy;Scanning and Transmission electron microscopy ;Freeze-tech and Freeze-fracture methods for EM,ELISA,FACS,Spectroscopy (NMR,IR,MS etc).Chromatography-TLC,Gas,Column,HPLC;Electrophoresis(DNA and Protein separation techniques),PCR-Nested PCR,Real time PCR and Inverse PCR;Hybridisation ;Blotting Techniques-Western,Southern and Norhtern;Automation in diagnostics,Nanotechniques,Bioprocess,DNAsequencing,Proteinsequencing,Chemical synthesis of DNA and Protein.

## Paper: MBCW 05/CPE-RPE

### Course structure

- The course comprises of six modules listed in table below. Each module has 4-5 units.

Modules	Unit title	Teaching hours
<b>Theory</b>		
RPE 01	Philosophy and Ethics	4
RPE 02	Scientific Conduct	4
RPE 03	Publication Ethics	7
<b>Practice</b>		
RPE 04	Open Access Publishing	4
RPE 05	Publication Misconduct	4
RPE 06	Databases and Research Metrics	7
	<b>Total</b>	<b>30</b>

### Syllabus in detail

#### THEORY

- RPE 01: PHILOSOPHY AND ETHICS (3 hrs.)**
  - Introduction to philosophy: definition, nature and scope, concept, branches
  - Ethics: definition, moral philosophy, nature of moral judgements and reactions
- RPE 02: SCIENTIFIC CONDUCT (5hrs.)**
  - Ethics with respect to science and research
  - Intellectual honesty and research integrity
  - Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
  - Redundant publications: duplicate and overlapping publications, salami slicing
  - Selective reporting and misrepresentation of data
- RPE 03: PUBLICATION ETHICS (7 hrs.)**
  - 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 contributorship
  - Identification of publication misconduct, complaints and appeals
  - Predatory publishers and journals

#### PRACTICE

- RPE 04: OPEN ACCESS PUBLISHING(4 hrs.)**
  - Open access publications and initiatives

2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

- **RPE 05: PUBLICATION MISCONDUCT (4hrs.)**

- 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

- **RPE 06: DATABASES AND RESEARCH METRICS (7hrs.)**

- A. Databases (4 hrs.)**

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

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