

**AC: 09/12/2020**  
**Item No.:- 5.4**



**RAYAT SHIKSHAN SANSTHA'S**  
**KARMAVEER BHURAO PATIL COLLEGE, VASHI**  
**NAVI MUMBAI**  
**[AUTONOMOUS COLLEGE]**

**DEPARTMENT OF MICROBIOLOGY**

**Program: M. Sc. Microbiology**  
**Course: M.Sc. Part II**

**Elective Course: Biostatistics & Bioinformatics**

**Choice Based Credit and Grading System**  
**2020-21**

## **Preamble**

Masters of Science (M.Sc.) in Microbiology is a post graduate program of Department of Microbiology, Karmaveer Bhaurao Patil College Vashi, Navi Mumbai [Autonomous College]

The credit based semester and grading system and continuous evaluation consisting of components of Internal Assessment and External Assessment followed by the esteemed University of Mumbai, have been maintained while the syllabus for Elective course Microbiology was proposed for M.Sc. Semester -III & IV to be implemented with effect from 2020-21. The proposed syllabus and introduction of new concepts passed several rounds of discussion before being presented to the members of Board of Studies for Microbiology, with Dr. Keshav Shinde as the Chairperson.

In order to assist students in developing research skills in general and in specific area of their interest/ specialization in particular, with respect to Biostatistics and Bioinformatics. This component will provide students with an opportunity to conduct independent research in the subject of Microbiology and Allied sciences.

In order to enhance employability of students in various allied areas, curricula focusing on understanding of theoretical foundations and practical techniques required in R & D, quality control,

The paper on “Biostatistics and Bioinformatics” will keep students abreast with current topics trending in the subject of Microbiology and the continually evolving world of knowledge.

### Objectives of the Course:

1. To revise and impart to the students, knowledge of the basic techniques of Biostatistics & Bioinformatics
2. To understand the basic concepts of statistics and apply them.
3. To learn the concepts to analyze multivariate data.
4. To enable the students to make use of the tools of bioinformatics to solve biological problems
5. Create attentiveness of the importance of Biostatistics& Bioinformatics in society.

### Program Outcomes (POs)

<b>PO-1</b>	<b>Disciplinary Knowledge and Skills:</b> Acquire the comprehensive and in-depth knowledge of various subjects in sciences such as physics, Chemistry, Mathematics, Microbiology, Bio-analytical Science, Computer Science, Data Science, Information Technology and disciplinary skills and ability to apply these skills in the field of science, technology and its allied branches.
<b>PO-2</b>	<b>Communication and Presentation Skills:</b> Develop various communication skills including presentation to express ideas evidently to achieve common goals of the organization.
<b>PO-3</b>	<b>Creativity and Critical Judgement:</b> Facilitate solutions to current issues based on investigations, evaluation and justification using evidence based approach.
<b>PO-4</b>	<b>Analytical Reasoning and Problem Solving:</b> Build critical and analytical attitude in handling the problems and situations.
<b>PO-5</b>	<b>Sense of Inquiry:</b> Curiously raise relevant questions based on highly developed ideas, scientific theories and its applications including research.
<b>PO-6</b>	<b>Use of Digital Technologies:</b> Use various digital technologies to explore information/data for business, scientific research and related purposes.
<b>PO-7</b>	<b>Research Skills:</b> Construct, collect, investigates, evaluate and interpret information/data relevant to science and technology to adapt, evolve and shape the future.
<b>PO-8</b>	<b>Application of Knowledge:</b> Develop scientific outlook to create consciousness against the social myths and blind faith.
<b>PO-9</b>	<b>Moral and Ethical Reasoning:</b> Imbibe ethical, moral and social values to develop virtues such as justice, generosity and charity as beneficial to individuals and society at large.
<b>PO-10</b>	<b>Leadership and Teamwork:</b> Work cooperatively and lead proactively to achieve the goals of the organization by implementing the plans and projects in various field-based situations related to science, technology and society at large.

<b>PO-11</b>	<b>Environment and Sustainability:</b> Create social awareness about environment and develop sustainability for betterment of future.
<b>PO-12</b>	<b>Lifelong Learning:</b> Realize that pursuit of knowledge is a lifelong activity and in combination with determined efforts, positive attitude and other qualities to lead a successful life.

### **Programme Specific Outcomes (PSOs):**

At the end of the two year programme the student will understand and be able to-

**PSO1.** Explain different branches of Microbiology such as Bacteriology, Virology, Immunology and Medical.

**PSO2.** Explain about various applications of Microbiology such as Environmental Microbiology, Industrial Microbiology, Food and Dairy Microbiology, Pharmaceutical Microbiology. Food Licensing and Certification and Quality assurance and Quality control, Biostatistics, Bioinformatics, Public health etc.

**PSO3.** Design and execute experiments related to Basic Microbiology, Immunology, Molecular Biology, Recombinant DNA Technology, and Microbial Genetics.

**PSO4.** Execute Research Project incorporating techniques of Basic and Advanced Microbiology under supervision and Hands on training (Internship)

**PSO5.** Take up a suitable position in academia or industry, and to pursue a career in research if so desired.

### **M.Sc. Elective Course: Microbiology Curriculum Revised for Credit Based Semester & Grading System To be implemented from the academic year 2020-2021**

#### **SEMESTER III**

#### **Course Learning Outcome:-**

**By the end of the course, a student should develop the ability to**

#### **PGMBEC301: Biostatistics**

CO1: Understand the fundamental concepts of Statistics [2]\*

CO2: Calculate Standard deviation [5]\*

CO3: Evaluate Data using Correlation & Regression [5]\*

CO4: Compare the role of different Testing [4]\*

CO5: Understand the method of Null Hypothesis & other tests [3]\*

CO6: Describe features of ANOVA [2]\*

**\*Note: [1]: Remembering, [2]: Understanding, [3]: Applying, [4]: Analysing, [5]: Evaluating, [6]: Creating**

**Theory:**

COURSE CODE	UNIT	TOPIC HEADINGS	Credits	NH/ week
PGMBEC301 Biostatistics	Unit I	Introduction to Statistics & Central Tendency	4	4
	Unit II	Testing		
	Unit III	Tests of significance		
	Unit IV	Correlation & Regression Tests		

SEMESTER III Paper I		
Course Code	Title	Credits
PGMBEC301	Biostatistics	4 Credits (60 Lectures)
Unit I	Introduction to Statistics & Central Tendency Statistical population Sample from population Random sample Central Tendency: Mean, Median and Mode Standard Deviation	(15 Notional Hours)
Unit II	Testing Gaussian Distribution and testing for normality, Non-parametric tests (Sign test, Wilcoxon test, Mann-Whitney Test, Kruskal–Wallis test), Transforming data to create Gaussian Distribution	(15 Notional Hours)

<p><b>Unit III</b></p>	<p><b>Tests of significance</b></p> <p>Test of Significance. Hypothesis testing:- Theory of errors- Type I and Type II errors</p> <p>Null hypothesis</p> <p>P values-one v/s two tail P values, t test(paired &amp; unpaired), z-test, Chi square test</p> <p>Contingency table</p>	<p><b>(15 Notional Hours)</b></p>
<p><b>Unit IV</b></p>	<p><b>Correlation &amp; Regression Tests</b></p> <p>Comparing three or more groups-Introduction to ANOVA, One way ANOVA, Two way ANOVA , (Repeated measures ANOVA), Friedman Test. Correlation and Regression: Linear and multiple Correlation and Regression.</p>	<p><b>(15 Notional Hours)</b></p>

### References

1. An Introduction to Biostatistics (Second Edition-2005) N. Gurumani M J P Publishers
2. Basic Biostatistics (2008) B. Burt Gerstman Jones and Bartlett Publishers
3. Biostatistics: A foundation For Analysis in Health Sciences (7th Edition 1999) Wayne W. Daniel John Wiley & Sons Inc.
4. Fundamentals of Biostatistics (2006) Veer Bala Rastogi Ane Books India
5. Biostatistics- the Bare Essentials (2<sup>nd</sup> Edition 2000) Nosman Streiner B. C. Decker Inc.

**Note:**

- 1) **Green Color:** Topics related to Local/National/Regional & global development needs
- 2) **Blue Color:** Topics related to Employability/Entrepreneurship/Skill Development
- 3) **Yellow Color:** Topics related to professional ethics, gender, human values, Environment & Sustainability

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**SEMESTER IV**

**Course Learning Outcome:**

**By the end of the course, a student should develop the ability to-**

**Semester IV:**

**PGMBEC401: Bioinformatics**

CO1: Classify and evaluate various data bases [4]\*

CO2: Carry out Sequence analysis [5]\*

CO3: Enlist different methods of Gene prediction [1]\*

CO4: Understand the method Protein modeling and drug design & other tools [3]\*

CO5: Evaluate & predicate Secondary and tertiary structure of protein [5]\*

CO6: Describe features of proteomics [2]\*

CO7: Apply Phylogenetic trees [4]\*

**\*Note: [1]: Remembering, [2]: Understanding, [3]: Applying, [4]: Analysing, [5]: Evaluating, [6]: Creating**

**Theory**

<b>COURSE CODE</b>	<b>UNIT</b>	<b>TOPIC HEADINGS</b>	<b>Credits</b>	<b>NH/ week</b>
<b>PGMBEC401 Bioinformatics</b>	<b>Unit I</b>	<b>Introduction to Bioinformatics</b>	<b>4</b>	<b>4</b>
	<b>Unit II</b>	<b>Gene Prediction &amp; Transcriptomics</b>		
	<b>Unit III</b>	<b>Protein Computational Biology &amp; Tools</b>		
	<b>Unit IV</b>	<b>Genomics Proteomics &amp; Phylogenetic analysis</b>		

<b>SEMESTER IV</b>		
<b>Course Code</b>	<b>Title</b>	<b>Credits</b>
<b>PGMBEC401</b>	<b>Bioinformatics</b>	<b>4 Credits (60 Lectures)</b>
<b>Unit I</b>	<p><b>Introduction to Bioinformatics</b></p> <p>Introduction to Bioinformatics:</p> <p>Overview, Internet and bioinformatics, Applications</p> <p>Databases: Databases in Bioinformatics, various biological databases, Protein and Nucleotide sequence Data bases. Protein sequence, structure and Classification databases</p> <p>Sequence analysis: Pairwise alignment, local and global alignment, Scoring matrices, multiple sequence alignment, tools for sequence alignment, programming algorithms</p>	<b>(15 Notional Hours)</b>



<p><b>Unit II</b></p>	<p><b>Gene Prediction &amp; Transcriptomics</b></p> <p>Gene prediction: Gene structure in Prokaryotes and Eukaryotes, Gene prediction methods:</p> <p>Neural Networks, Pattern Discrimination methods, Signal sites Predictions, Evaluation of Gene Prediction methods.</p> <p>Transcriptomics: Complete transcript cataloguing and gene discovery- sequencing based approach, Microarray based technologies and computation based technologies.</p> <p>RNA secondary structure prediction</p>	<p><b>(15 Notional Hours)</b></p>
<p><b>Unit III</b></p>	<p><b>Protein Computational Biology &amp; Tools</b></p> <p>Protein Computational Biology: Structural classification of proteins, Protein structure analysis, structure alignment and comparison, Secondary and tertiary structure prediction and evaluation, prediction of specialized structures, Active site prediction, Protein folding, Protein modeling and drug design</p> <p>Tools in Bioinformatics: ProtParam, Translate, BioEdit, FindMod, COILS, TMHMM, RasMol, DeepView</p>	<p><b>(15 Notional Hours)</b></p>
<p><b>Unit IV</b></p>	<p><b>Genomics, Proteomics &amp; Phylogenetic analysis</b></p> <p>Genomics: Comparative Genomics</p> <p>Proteomics: Types of proteomics, tools for proteomics- separation and isolation of proteins, acquisition of protein structure information, databases and applications</p> <p>Phylogenetic analysis: molecular basis of evolution, Phylogenetic trees &amp; different methods for phylogenetic inference</p>	<p><b>(15 Notional Hours)</b></p>

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- 2) **Blue Color:** Topics related to Employability/Entrepreneurship/Skill Development
- 3) **Yellow Color:** Topics related to professional ethics, gender, human values, Environment & Sustainability

## References

1. Developing Bioinformatics Computer Skills: Cynthia Gibas & Per Jambeck (2001). Shroff Publishers & Distributors Pvt. Ltd (O'Reilly), Mumbai.
2. Bioinformatics Basics: Applications in Biological Science and Medicine, H.H. Rashidi & L.K Buehler (2002). CRC Press, London.
3. Bioinformatics: Sequence, structure and databanks, Des Higgins & Willie Taylor (2002). Oxford University Press.
4. Bioinformatics: A practical guide to the analysis of genes and proteins, Baxevanis A.D & Ouellette B.E.F (2001) Wiley Interscience - New York
5. Bioinformatics: A Beginners Guide, Clavarie and Notredame
6. Bioinformatics: David Mount
7. Bioinformatics: Rastogi
8. Introduction to Bioinformatics: Arthur M. Lesk
9. Bioinformatics: Principles and applications, Ghosh and Mallick
10. Bioinformatics: Genes, Proteins and Computer, C A Orengo