

Resolution Number: AC/II(23-24).2.RUS1

S. P. Mandali's

Ramnarain Ruia Autonomous College

(Affiliated to University of Mumbai)



Syllabus for:

**Program: Integrated M.Sc. in Bioanalytical sciences
(S.Y. B.Sc. Syllabus)**

Program Code: RUSBAS

(As per the guidelines of National Education Policy
2020-Academic year 2024-25)

(Choice based Credit System)

GRADUATE ATTRIBUTES

GA	GA Description A student completing Bachelor's Degree in Science program will be able to:
GA 1	Recall and explain acquired scientific knowledge in a comprehensive manner and apply the skills acquired in their chosen discipline. Interpret scientific ideas and relate its interconnectedness to various fields in science.
GA 2	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organise data and draw inferences.
GA 3	Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools.
GA 4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyse results.
GA 5	Take complex challenges, work responsibly and independently, as well as in cohesion with a team for completion of a task. Communicate effectively, convincingly and in an articulate manner.
GA 6	Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.
GA 7	Follow ethical practices at work place and be unbiased and critical in interpretation of scientific data. Understand the environmental issues and explore sustainable solutions for it.
GA 8	Keep abreast with current scientific developments in the specific discipline and adapt to technological advancements for better application of scientific knowledge as a lifelong learner.

Program Outcomes (PO)

PO	Description
PO 1	A student completing Bachelor's Degree in Science program in the subject of Bioanalytical Sciences will be able to: Gain high quality science education in a vibrant academic ambience with the faculty of distinguished teachers and scientists.
PO 2	Take up the challenge of doing quality research and teaching and also contribute to industrial production and R & D in the fields of Bioanalysis, Bioinformatics and Nutraceutical Sciences.
PO 3	Amalgamate classical analytical chemical techniques with modern genomic and proteomic technologies of manufacturing and analysis to better characterize the products useful as medicines as well as nutraceuticals.

Ramnarain Ruia Autonomous College

Semester III

Course Code: RUSMIBAS0204

Subject IV: Computational Sciences

Course Title: Statistics II

Type Course: Discipline Specific Core Course (Minor)

Academic Year 2024-25

S. Y. B.Sc.

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION
CO 1	Analyze significance and validity of experimental results with statistical tests such as correlation and regression
CO 2	Apply the concepts of probability theory in biostatistics.
CO 3	Apply hypothesis testing in validating experimental results.

Paper Code	Semester III	Credits/ Hours
RUSMIBAS0204	Statistics II	3/45
204.1 Correlation, Simple linear Regression Analysis		15
1. Visualizing relationship using Scatter Diagram, 2. Karl Pearson's Product moment correlation coefficient and its properties. 3. Spearman's Rank correlation. (With and without ties) 4. Concept of Simple linear regression. Principle of least squares. Fitting a straight line by method of least squares (Linear in Parameters) 5. Relationship between regression coefficients and correlation coefficient, cause and effect relationship, Spurious correlation. 6. Concept and use of coefficient of determination (R^2). 7. Measures of association with the help of Tau A, Tau B, Tau C, Gamma and Lambda, Somer's d		

204.2 Probability Theory	15
<ol style="list-style-type: none"> 1. Trial, random experiment, sample point and sample space. 2. Definition of an event, mutually exclusive and exhaustive events. 3. Classical (Mathematical) and Empirical definitions of Probability -Discrete random variable 4. Random variable- Discrete and Continuous 5. Standard Discrete Probability Distribution Functions Binomial, Poisson (Concept Only) 6. Standard Continuous Probability Distribution Functions: Normal, t, Chi-square and F distribution (Concept only) 	
204.3 Basic concepts of Theory of estimation and hypothesis testing	15
<ol style="list-style-type: none"> 1. Point and Interval estimate of single mean, single proportion from sample of large size. 2. Statistical tests: Concept of hypothesis, Null and Alternative Hypothesis, Types of Errors, Critical region, Level of significance, Power 3. Small sample tests-Independent sample t-test, paired t-test. Concept of p-value. (Use of Excel and SPSS) 	

RUSMIBASPO204	PRACTICALS	Credits/Hours
		1/30
<p>Determination of the following parameters for the given experimental data:</p> <ol style="list-style-type: none"> 1. Average, std. deviation, std. error 2. Correlation coefficient 3. Identify the error and its type for the given experimental data 4. Apply appropriate tests for hypothesis testing based on the given experimental data 		

Reference Books:

Statistics II	<ul style="list-style-type: none">• Probability and measurement by P. Billingsley• Introduction to probability theory by Das• Testing Statistical Hypotheses: Lehmann, Erich L., Romano, Joseph P.• Introduction to Linear Regression Analysis (Wiley Series): Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining
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Semester IV

Course Code: RUSMIBASE214

Subject IV: Computational Sciences

Course Title: Bioinformatics

Type of Course: Discipline Specific Core Course (Minor)

Academic Year 2024-25

S. Y. B.Sc.

Course outcomes:

C01	Describe various bioinformatics databases
C02	Apply bioinformatics databases and tools to study DNA and protein sequences, protein structure and metabolic pathways
C03	Explain the various methods for pairwise sequencing alignment

Paper Code	Semester IV	Credits/Hours 3/45
RUSMIBASE214	Bioinformatics	
214.1	Introduction to Bioinformatics	15
	<ol style="list-style-type: none"> 1. Introduction to Bioinformatics & Databases Application of Bioinformatics 2. Major Bioinformatics resources: NCBI, EBI, ExPASy 3. Nucleic acid: GENBANK, EMBL, DDBJ, INSDC 4. Protein structure: Domains, motifs (Pfam/Prosites) 5. Protein sequence databases: Uniports, PIR, SWISSPROT, TrEMBL 6. Literature database: PUBMED 7. Genome database: GSS, Genome 8. Specialized database: OMIM 9. Protein structure databases: PDB 10. Metabolic Pathway database: KEGG 	
214.2	Basics of Sequencing	15
	<ol style="list-style-type: none"> 1. Molecular biology basics Genomics 2. Proteomics 3. DNA sequencing technology: Whole-genome shotgun sequencing strategies Protein sequencing methods 4. Sequence File formats 	
214.3	Pairwise Sequence Alignment	15
	<ol style="list-style-type: none"> 1. Basic Concepts of sequences similarity, Identity and homology Definition of homologs, orthologs, paralogs 2. Concepts of sequence alignments Pairwise sequence alignment methods DOT Matrix analysis 3. Scoring matrices: Basic concepts of scoring matrix, PAM and BLOSUM series and Principles based on which these matrices are derived 	
RUSMIBASPE214	PRACTICALS	Credits/Hours 1/30
	<ol style="list-style-type: none"> 1. INSDC- NCBI, EMBL, DDBJ 2. Sequence databases- EMBL-EBI, GenBank, UniProt 3. Structure databases- PDB 4. Domain database: Prosites, PRINT, Pfam. 5. Specialized database: KEGG, PUBMED, OMIM, Use of Rasmol 	

References:

Computational Sciences	<ul style="list-style-type: none"> • Computational Biology and Bioinformatics: Ka-Chun Wong • Chapter 1, Advanced Data Mining Technologies in Bioinformatics
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