

# SAURASHTRA UNIVERSITY, RAJKOT



**Accredited Grade “A” by NAAC (CGPA 3.05)**

**COURSE STRUCTURE & SYLLABUS**

**FOR**

**UNDERGRADUATE PROGRAMME**

**IN**

**BIOINFORMATICS**

**Semester V & VI**

**(Faculty of Science)**

**[As per Choice Based Credit System (CBCS) as recommended by UGC]**

**Effective from June - 2018**

## Annexure – “B”

SAURASHTRA UNIVERSITY  
SCIENCE FACULTYSubject: **BIOINFORMATICS**

Sr. No.	Level	Semester	Course Group	Course (Paper) Title	Course (Paper) No.	Credit	Internal Marks	External Marks	Practical /Viva Marks	Total Marks	Course (Paper) Unique Code
01	UG	05	Core	BI.501 Genomics	BI-501	5	30	70	50	150	1603 2200 0105 0100
02	UG	05	Core	BI.502 Applied Genomics & Transcriptomics	BI-502	5	30	70	50	150	1603 2200 0105 0200
03	UG	05	Core	BI.503 Proteomics	BI-503	5	30	70	50	150	1603 2200 0105 0300
04	UG	05	Core	BI.504 Advanced Omics Technology	BI-504	5	30	70	50	150	1603 2200 0105 0400
05	UG	05	Core	BI.505 Python & R Programming	BI-505	4	30	70	50	150	1603 2200 0105 0500
06	UG	06	Core	Bioinformatics Project	BI-601	5	225	-	525	750	1603 2200 0106 0100

**SKELETON OF COMPLETE COURSE CONTENT OF  
UNDER GRADUATE BIOINFORMATICS  
SEMESTER V&IV**

<b>SEMESTER</b>	<b>PAPER NO. &amp; CODE</b>	<b>TITLE OF THE PAPER</b>	<b>CREDIT</b>
V	BI-501 (Theory)	Genomics	3
	BI-501 (Practical)	-do-	2
	BI-502 (Theory)	Applied Genomics & Transcriptomics	3
	BI-502 (Practical)	-do-	2
	BI-503 (Theory)	Proteomics	3
	BI-503 (Practical)	-do-	2
	BI-504 (Theory)	Advanced Omics Technology	3
	BI-504 (Practical)	-do-	2
	BI-505 (Theory)	Python & R Programming	3
	BI-505 (Practical)	-do-	1
VI	BI-601 (Practical)	Bioinformatics Project	24

**FACULTY OF SCIENCE**

**Syllabus**

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Genomics (BI.501)

Course (Paper) Unique Code: 1603 2200 0105 0100

External Exam Time Duration: 2 Hours and 30 minutes

<b>Name of Program</b>	<b>Semester</b>	<b>Course Group</b>	<b>Credit</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Practical /Viva Marks</b>	<b>Total Marks</b>
Bachelor of Science	05	Core	5	30	70	50	150

Course Objective:

- To uncover basics of Genomics and Genome Analysis

**COURSE STRUCTURE FOR UG PROGRAMME  
BIOINFORMATICS- 501  
SEMESTER- V**

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
V	BI-501 (Theory)	Genomics	5	3	2.5 hrs	30	70	100
V	BI-501 (Practical)	Genomics	3	2	One day per batch	15	35	50
Total credits				5	Total marks			150

**General instructions**

1. The medium of instruction will be English for theory and practical courses
2. There will be 5 lectures / week / theory paper / semester.
3. Each lecture will be of 55 mins.
4. There will be 1 practical / week / paper / batch. Each practical will be of 3 periods
5. Each semester theory paper will be of “five” units. There will be 40 hrs. of theory teaching / paper / semester.
6. Each Theory Paper / Semester will be of 100 Marks. There will be 30 marks for internal evaluation and 70 marks for external evaluation. Each Practical Paper / Semester will be of 50 Marks with 15 marks for internal and 35 marks for external evaluation. So, Total Marks of Theory and Practical for each Paper will be 150. (100 + 50 = 150)

**SKELETON OF THEORY EXAMINATION PAPER -EXTERNAL**

**(SEMESTER –V)**

Total five questions. One question from each unit. Each question having equal weightage of 14 Marks		
a) Four One mark questions (All compulsory)	4 x 1= 4 Marks	14 Marks
b) Answer specifically- (attempt any one out of two)	1 x 2= 2 Marks	
c) Short Questions - (attempt any one out of two)	1 x 3= 3 Marks	
d) Answer in detail – (attempt any one out of two)	1 x 5= 5 Marks	

**General Instructions**

1. Time duration of each theory paper will be of two and half hours.
2. Total marks of each theory paper will be 70 marks.
3. There will be internal option for all the questions (as shown in table above)
4. All questions are compulsory

**BI.501 Genomics**

## (Theory)

### Unit I: Genomics- Basics

- Genomics: Introduction and Branches, Genome Size, Sequence complexity
- Genome structure in viruses and prokaryotes
- Organization of organelle genomes
- Organization of nuclear DNA in eukaryotes
- Gene families
- HUGO Gene Nomenclature Committee
- Gene Ontology Consortium

### Unit II: Genome sequencing

- A field guide to whole-genome sequencing, assembly and annotation
- The sequence of sequencers: The history of sequencing DNA
- High Throughput Sequencing: An Overview of Sequencing Chemistry
- Coming of age: ten years of next generation sequencing technologies
- Comparison of Next-Generation Sequencing Systems
- Applications of next-generation sequencing technologies
- ChIP-seq analysis

### Unit III: Exome Sequencing & Sequence Assembly

- Exome Sequencing: Current and Future Perspectives
- Novel bioinformatic developments for exome sequencing
- Review of Current Methods, Applications, and Data Management for the Bioinformatics Analysis of Whole Exome Sequencing
- Sequence Assembly
- Recent advances in sequence assembly: principles and applications
- New advances in sequence assembly
- List of (genome) sequence assembly software

### Unit IV: Genome annotation

- Gene Prediction Methods and tools
- Genome annotation
- NCBI Prokaryotic & Eukaryotic Genome Annotation Pipeline
- The Ensembl gene annotation system
- An optimized approach for annotation of large eukaryotic genomic sequences using genetic algorithm.
- Fast Genome-Wide Functional Annotation through Orthology Assignment by eggNOG-Mapper

- KAAS: an automatic genome annotation and pathway reconstruction server

### **Unit V: Pseudogenes & Pharmacogenomics**

- Pseudogenes & its prediction tools
- Pseudogenes and Their Genome-Wide Prediction in Plants
- SNP: Introduction, Databases & detection software
- Overview of Personalized medicine, Web Resources for Pharmacogenomics
- Basic concepts of Epigenomics

### **BI.501 Genomics** **(Practical)**

Based on theory syllabus

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**Annexure – “C”**

**FACULTY OF SCIENCE**

**Syllabus**

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Applied Genomics & Transcriptomics (BI-502)

Course (Paper) Unique Code: 1603 2200 0103 0200

External Exam Time Duration: 2 Hours and 30 minutes

<b>Name of Program</b>	<b>Semester</b>	<b>Course Group</b>	<b>Credit</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Practical /Viva Marks</b>	<b>Total Marks</b>
Bachelor of Science	05	Core	5	30	70	50	150

Course Objective:

- To understand Applied Genomics & Gene expression analysis

**COURSE STRUCTURE FOR UG PROGRAMME  
BIOINFORMATICS- 502  
SEMESTER- V**

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
I	BI-502 (Theory)	Applied Genomics & Transcriptomics	5	3	2.5 hrs	30	70	100
I	BI-502 (Practical)	Applied Genomics & Transcriptomics	3	2	One day per batch	15	35	50
Total credits				5	Total marks			150

**General instructions**

1. The medium of instruction will be English for theory and practical courses
2. There will be 5 lectures / week / theory paper / semester.
3. Each lecture will be of 55 mins.
4. There will be 1 practical / week / paper / batch. Each practical will be of 3 periods
5. Each semester theory paper will be of “five” units. There will be 50 hrs. of theory teaching / paper / semester.
6. Each Theory Paper / Semester will be of 100 Marks. There will be 30 marks for internal evaluation and 70 marks for external evaluation. Each Practical Paper / Semester will be of 50 Marks with 15 marks for internal and 35 marks for external evaluation. So, Total Marks of Theory and Practical for each Paper will be 150. (100 + 50 = 150)

**SKELETON OF THEORY EXAMINATION PAPER -EXTERNAL  
(SEMESTER- V)**

Total five questions. One question from each unit. Each question having equal weightage of 14 Marks		
a) Four One mark questions (All compulsory)	4 x 1= 4 Marks	14 Marks
b) Answer specifically- (attempt any one out of two)	1 x 2= 2 Marks	
c) Short Questions - (attempt any one out of two)	1 x 3= 3 Marks	
d) Answer in detail – (attempt any one out of two)	1 x 5= 5 Marks	

**General Instructions**

1. Time duration of each theory paper will be of two and half hours.
2. Total marks of each theory paper will be 70 marks.
3. There will be internal option for all the questions (as shown in table above)
4. All questions are compulsory

## **BI.502 Applied Genomics & Transcriptomics**

### **(Theory)**

#### **Unit I: Applied Genomics-1**

- Subtractive Genomics & Reverse Vaccinology approaches
- Overview of Comparative Genomics; Comparative Genomics of prokaryotes, Organelles & Eukaryotes
- Overview of Pangenomics; A brief review of software tools for pangenomics
- Overview of Agrigenomics, Nutrigenomics & Animal genomics
- Computational polypharmacology: a new paradigm for drug discovery
- A Survey on the Computational Approaches to Identify Drug Targets in the Postgenomic Era
- Computational approaches in target identification and drug discovery; A Computational Approach to Finding Novel Targets for Existing Drugs

#### **Unit II: Applied Genomics-2(Metagenomics)**

- Metagenomics-Introduction
- Metagenomics: The Next Culture-Independent Game Changer
- Microbial metagenomics: beyond the genome.
- Marine metagenomics as a source for bioprospecting
- Metagenomic Assembly: Overview, Challenges and Applications
- EBI Metagenomics
- Databases of the marine metagenomics

#### **Unit III: Applied Genomics-3 (Microbiomics)**

- The human microbiome
- Structure and function of the human skin microbiome
- Skin microbiome: genomics-based insights into the diversity and role of skin microbes.
- Application of metagenomics in the human gut microbiome
- The potential impact of gut microbiota on your health: Current status and future challenges.
- Ecology of the Oral Microbiome: Beyond Bacteria.
- Gut Microbiota and Salivary Diagnostics: The Mouth Is Salivating to Tell Us Something.

#### **Unit IV: Transcriptomics – Basics & ncRNAs**

- Transcription of Protein-Coding Genes and Formation of Functional mRNA
- The Decoding of mRNA by tRNAs
- List of RNAs & Overview of Non-coding RNA
- Gene Family: Non-coding RNAs
- Current Research on Non-Coding Ribonucleic Acid (RNA)
- Noncoding RNAs: Clinical and Therapeutic Applications
- A Review on Recent Computational Methods for Predicting Noncoding RNAs

#### **Unit V: Transcriptomics technologies**

- Transcriptomics technologies
- RNA sequencing: advances, challenges and opportunities
- Transcriptome analysis using next-generation sequencing
- Transcriptomics in the RNA-seq era
- A survey of best practices for RNA-seq data analysis
- RNA-Seq bioinformatics tools

### **BI.502 Applied Genomics & Transcriptomics**

#### **(Practical)**

Based on theory syllabus

#### **References:**

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**Annexure – “C”**

**FACULTY OF SCIENCE**

**Syllabus**

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Proteomics (BI-503)

Course (Paper) Unique Code: 1603 2200 0105 0300

External Exam Time Duration: 2 Hours and 30 minutes

<b>Name of Program</b>	<b>Semester</b>	<b>Course Group</b>	<b>Credit</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Practical /Viva Marks</b>	<b>Total Marks</b>
Bachelor of Science	05	Core	5	30	70	50	150

Course Objective:

- To understand Proteomics and its technology

**COURSE STRUCTURE FOR UG PROGRAMME  
BIOINFORMATICS- 503  
SEMESTER- V**

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
V	BI-503 (Theory)	Proteomics	5	3	2.5 hrs	30	70	100
V	BI-503 (Practical)	Proteomics	3	2	One day per batch	15	35	50
Total credits				5	Total marks			150

**General instructions**

1. The medium of instruction will be English for theory and practical courses
2. There will be 5 lectures / week / theory paper / semester.
3. Each lecture will be of 55 mins.
4. There will be 1 practical / week / paper / batch. Each practical will be of 3 periods
5. Each semester theory paper will be of “five” units. There will be 50 hrs. of theory teaching / paper / semester.
6. Each Theory Paper / Semester will be of 100 Marks. There will be 30 marks for internal evaluation and 70 marks for external evaluation. Each Practical Paper / Semester will be of 50 Marks with 15 marks for internal and 35 marks for external evaluation. So, Total Marks of Theory and Practical for each Paper will be 150. (100 + 50 = 150)

**SKELETON OF THEORY EXAMINATION PAPER -EXTERNAL**

**(SEMESTER- V)**

Total five questions. One question from each unit. Each question having equal weightage of 14 Marks		
a) Four One mark questions (All compulsory)	4 x 1= 4 Marks	14 Marks
b) Answer specifically- (attempt any one out of two)	1 x 2= 2 Marks	
c) Short Questions - (attempt any one out of two)	1 x 3= 3 Marks	
d) Answer in detail – (attempt any one out of two)	1 x 5= 5 Marks	

**General Instructions**

1. Time duration of each theory paper will be of two and half hours.
2. Total marks of each theory paper will be 70 marks.
3. There will be internal option for all the questions (as shown in table above)
4. All questions are compulsory

## **BI.503 Proteomics** **(Theory)**

### **Unit I: Proteomics- Basics & Strategies for protein separation**

- The origin and scope of proteomics
- Post-translational modification
- dbPTM 2016: 10-year anniversary of a resource for post-translational modification of proteins.
- Proteomics: Technologies and Their Applications.
- General principles of protein separation in proteomics
- Principles of two-dimensional gel electrophoresis
- The application of 2dge in proteomics
- Principles of multidimensional liquid chromatography
- Multidimensional liquid chromatography strategies in proteomics

### **Unit II: Strategies for protein identification & quantitation**

- Protein identification with antibodies
- Determination of protein sequences by chemical degradation
- Mass spectrometry—basic principles and instrumentation
- Protein identification using data from mass spectra
- Quantitative proteomics based on 2DGE
- Multiplexed in-gel proteomics
- Quantitative mass spectrometry

### **Unit III: Interaction proteomics**

- Methods to study protein–protein interactions, Library-based methods for the global analysis of binary interactions
- Two-hybrid/protein complementation assays; Modified two-hybrid systems for membrane, cytosolic, and extracellular proteins
- Bacterial and mammalian Two-hybrid systems, Lumier and mappit high- throughput two-hybrid platform
- Adapted hybrid assays for different types of interactions, Systematic complex analysis by tandem affinity purification–mass spectrometry
- Analysis of protein interaction data, Protein interaction maps, Protein interactions with small molecules

#### **Unit IV: Protein modification in proteomics, Protein microarrays & Applications of proteomics**

- Methods for the detection of post-translational modifications, Enrichment strategies for modified proteins and peptides
- Phosphoproteomics, analysis of phosphoproteins by mass spectrometry, Quantitative analysis of phosphoproteins
- Glycoproteomics
- The evolution of protein microarrays, Different types of protein microarrays
- The manufacture of functional protein microarrays—protein synthesis, protein immobilization
- The detection of proteins on microarrays, Emerging protein chip technologies
- Diagnostic applications of proteomics, Applications of proteomics in drug development
- Proteomics in agriculture, Proteomics in industry—improving the yield of secondary metabolism
- Overview of Biomarker, Biomarker discovery, Technologies for Discovery of Biomarkers
- Transcription factor proteomics-Tools, applications, and challenges

#### **Unit V: Data Analysis**

- Proteomics resources at the EBI & ExPASy
- A Golden Age for Working with Public Proteomics Data
- Bioinformatic analysis of proteomics data
- Functional annotation and biological interpretation of proteomics data
- Web Resources for Mass Spectrometry-based Proteomics
- Protein post-translational modifications: In silico prediction tools and molecular modeling
- Glycobioinformatics: Current strategies and tools for data mining in MS-based glycoproteomics
- Databases and Associated Tools for Glycomics and Glycoproteomics

**BI.503 Proteomics**  
**(Practical)**  
Based on theory syllabus

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**Annexure – “C”**

**FACULTY OF SCIENCE**

**Syllabus**

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Advanced Omics Technology (BI-504)

Course (Paper) Unique Code: 1603 2200 0105 0500

External Exam Time Duration: 2 Hours and 30 minutes

<b>Name of Program</b>	<b>Semester</b>	<b>Course Group</b>	<b>Credit</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Practical /Viva Marks</b>	<b>Total Marks</b>
Bachelor of Science	05	Core	5	30	70	50	150

Course Objective:

- To understand the multiomics technology

**COURSE STRUCTURE FOR UG PROGRAMME  
BIOINFORMATICS- 504  
SEMESTER- V**

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
V	BI-504 (Theory)	Advanced Omics Technology	5	3	2.5 hrs	30	70	100
V	BI-504 (Practical)	Advanced Omics Technology	3	2	One day per batch	15	35	50
Total credits				5	Total marks			150

**General instructions**

1. The medium of instruction will be English for theory and practical courses
2. There will be 5 lectures / week / theory paper / semester.
3. Each lecture will be of 55 mins.
4. There will be 1 practical / week / paper / batch. Each practical will be of 3 periods
5. Each semester theory paper will be of “five” units. There will be 50 hrs. of theory teaching / paper / semester.
6. Each Theory Paper / Semester will be of 100 Marks. There will be 30 marks for internal evaluation and 70 marks for external evaluation. Each Practical Paper / Semester will be of 50 Marks with 15 marks for internal and 35 marks for external evaluation. So, Total Marks of Theory and Practical for each Paper will be 150. (100 + 50 = 150)

**SKELETON OF THEORY EXAMINATION PAPER -EXTERNAL  
(SEMESTER- V)**

Total five questions. One question from each unit. Each question having equal weightage of 14 Marks		
a) Four One mark questions (All compulsory)	4 x 1= 4 Marks	14 Marks
b) Answer specifically- (attempt any one out of two)	1 x 2= 2 Marks	
c) Short Questions - (attempt any one out of two)	1 x 3= 3 Marks	
d) Answer in detail – (attempt any one out of two)	1 x 5= 5 Marks	

**General Instructions**

1. Time duration of each theory paper will be of two and half hours.
2. Total marks of each theory paper will be 70 marks.
3. There will be internal option for all the questions (as shown in table above)
4. All questions are compulsory

## **BI.504 Advanced Omics Technology** **(Theory)**

### **Unit I: Peptidomics-1 (Biologically active peptides)**

- Current peptidomics: Applications, purification, identification, quantification, and functional analysis
- Plant Peptides: Bioactivity, Opportunities and Challenges
- Overview of any two examples of Plant Peptides (from the Book Handbook of Biologically Active Peptides (Second Edition))
- Antimicrobial Peptides
- Overview of Antimicrobial Peptides: Cathelicidins, Class II Non-Lantibiotic, Colicins, Defensins, Lantibiotics, Microcins, Nonribosomal Peptide Synthesis, Peptaibols
- Introduction to Bacteriocin & its type / Classes, Genetics and Regulation of Bacteriocin Synthesis, Mode of Action, Applications of Bacteriocins

### **Unit II: Peptidomics-2 (Biologically active peptides)**

Overview of any two examples from the each of the following categories of peptides (from the Book Handbook of Biologically Active Peptides (Second Edition)):

- Fungal Peptides, Invertebrate Peptides, Amphibian/Skin Peptides, Venom Peptides, Cancer/Anticancer Peptides, Vaccine Peptides

### **Unit III: Peptidomics-3 (Biologically active peptides)**

- Overview of any one examples from the each of the following categories of peptides (from the Book Handbook of Biologically Active Peptides (Second Edition)): Immune/Inflammatory Peptides, Brain Peptides, Endocrine Peptides, Ingestive Peptides, Gastrointestinal Peptides, Cardiovascular Peptides, Renal Peptides, Respiratory Peptides, Opiate Peptides, Neurotrophic Peptides, Blood-Brain Peptides
- In Silico Search for Biologically Active Peptides
- Overview of the following Peptide Topics: Peptides and Sleep, Peptides and Stress, Peptides and Temperature
- Pheromone Peptides, Prebiotic Peptides
- Allergen Peptides, Recombinant Allergens and Hypoallergens for Allergen-Specific Immunotherapy
- In silico Identification of Potential Peptides or Allergen Shot Candidates Against *Aspergillus fumigatus*

#### **Unit IV: Secretomics, Lipidomics, Metabolomics & Extremophilic Proteomics**

- Secretomics-Overview; Methodologies to decipher the cell secretome
- Lipidomics-Overview; Techniques, Applications, and Outcomes Related to Biomedical Sciences; Prospects from a technological perspective
- Metabolomics-Overview, Metabolomics techniques and technologies, Analytical platform and Analysis of metabolomic data
- Extracellular Microbial Metabolomics: The State of the Art; New frontiers in metabolomics: from measurement to insight.
- Overview of Extremophiles; Extremozymes: A Potential Source for Industrial Applications
- Extremophiles and biotechnology: current uses and prospects; Extremophiles as source of novel bioactive compounds with industrial potential
- Stability and solubility of proteins from extremophiles, Survival Mechanisms of Extremophiles, Protein Adaptations in Archaeal Extremophiles

#### **Unit V: Interactomics**

- Interactome & Interactomics – Overview; Interactomics: Connecting the dots
- Interactomics: toward protein function and regulation; Proteome-Scale Human Interactomics
- Pathway analysis- Overview; Integrating Networks and Proteomics: Moving Forward; Pathway and network analysis in proteomics
- Pathway analysis of genomic data: concepts, methods, and prospects for future development
- Ten years of pathway analysis: current approaches and outstanding challenges
- Introduction to Network Analysis in Systems Biology
- List of visualization tools for network biology

### **BI.504 Advanced Omics Technology** **(Practical)**

Based on theory syllabus

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**FACULTY OF SCIENCE**

**Syllabus**

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Python & R Programming (BI-505)

Course (Paper) Unique Code: 1603 2200 0106 0100

External Exam Time Duration: 2 Hours and 30 minutes

<b>Name of Program</b>	<b>Semester</b>	<b>Course Group</b>	<b>Credit</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Practical /Viva Marks</b>	<b>Total Marks</b>
Bachelor of Science	05	Core	4	30	70	50	150

Course Objective:

- To understand the Basics & Advanced of Python & R Programming

**COURSE STRUCTURE FOR UG PROGRAMME  
BIOINFORMATICS- 505  
SEMESTER- V**

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
V	BI-505 (Theory)	Python & R Programming	5	3	2.5 hrs	30	70	100
V	BI-505 (Practical)	Python & R Programming	3	1	One day per batch	15	35	50
Total credits				4	Total marks			150

**General instructions**

1. The medium of instruction will be English for theory and practical courses
2. There will be 5 lectures / week / theory paper / semester.
3. Each lecture will be of 55 mins.
4. There will be 1 practical / week / paper / batch. Each practical will be of 3 periods
5. Each semester theory paper will be of “five” units. There will be 50 hrs. of theory teaching / paper / semester.
6. Each Theory Paper / Semester will be of 100 Marks. There will be 30 marks for internal evaluation and 70 marks for external evaluation. Each Practical Paper / Semester will be of 50 Marks with 15 marks for internal and 35 marks for external evaluation. So, Total Marks of Theory and Practical for each Paper will be 150. (100 + 50 = 150)

**SKELETON OF THEORY EXAMINATION PAPER -EXTERNAL**

**(SEMESTER- V)**

Total five questions. One question from each unit. Each question having equal weightage of 14 Marks		
a) Four One mark questions (All compulsory)	4 x 1= 4 Marks	14 Marks
b) Answer specifically- (attempt any one out of two)	1 x 2= 2 Marks	
c) Short Questions - (attempt any one out of two)	1 x 3= 3 Marks	
d) Answer in detail – (attempt any one out of two)	1 x 5= 5 Marks	

**General Instructions**

1. Time duration of each theory paper will be of two and half hours.
2. Total marks of each theory paper will be 70 marks.
3. There will be internal option for all the questions (as shown in table above)
4. All questions are compulsory

## **BI.505 Python & R Programming** (Theory)

### **Unit I: Scripting languages for Bioinformatics-Python: Basics-1**

- Difference between Programming Language and Scripting Language
- Basics of scripting languages for Bioinformatics
- Basics Bash Shell Scripting
- Printing and manipulating text
- Reading and writing files

### **Unit II: Python: Basics-2**

- Lists and loops
- Writing our own functions
- Conditional tests
- Regular expressions
- Dictionaries
- Files, programs, and user input

### **Unit III: Advanced Python**

- Introduction
- Recursion and trees
- Complex data structures
- Object oriented Python
- Functional Python
- Iterators, comprehensions & generators
- Exception handling

### **Unit IV: R Programming-1**

- Comparison of statistical packages
- Overview of Statistical Analysis Software (SAS), Statistical Package for the Social Sciences (SPSS)
- Introduction and preliminaries
- Simple manipulations; numbers and vectors
- Objects, their modes and attributes
- Ordered and unordered factors
- Arrays and matrices, Lists and data frames

## Unit V: R Programming-2 & Bioconductor

- Reading data from files
- Probability distributions
- Grouping, loops and conditional execution
- Writing your own functions
- Statistical models in R, Graphical procedures
- Packages, OS facilities
- Bioconductor Workflows: Annotations, Gene expression, Single Cell, Genomic Variants, Epigenetics, Proteomics, Resource Querying

### **BI.505 Python & R Programming** (Practical)

Based on theory syllabus

#### **References**

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2. Jones, M. O. (2017). Advanced Python for Biologists (ISBN-13: 978-1495244377): CreateSpace Independent Publishing Platform. <http://pythonforbiologists.com>
3. <http://biopython.org/>
4. [https://www.sas.com/en\\_in/home.html](https://www.sas.com/en_in/home.html)
5. <https://www.ibm.com/analytics/data-science/predictive-analytics/spss-statistical-software>
6. <https://www.tutorialspoint.com/r/index.htm>
7. W. N. Venables, D. M. Smith and the R Core Team, An Introduction to R version 3.5.0 (2018-01-31) <https://cran.r-project.org/doc/manuals/r-devel/R-intro.pdf>
8. <https://www.r-project.org/about.html>
9. <https://cran.r-project.org/manuals.html>
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12. SAS (software). (2018, January 8). In Wikipedia, The Free Encyclopedia. Retrieved 00:36, February 2, 2018, from [https://en.wikipedia.org/w/index.php?title=SAS\\_\(software\)&oldid=819199510](https://en.wikipedia.org/w/index.php?title=SAS_(software)&oldid=819199510)
13. SPSS. (2018, January 25). In Wikipedia, The Free Encyclopedia. Retrieved 00:37, February 2, 2018, from <https://en.wikipedia.org/w/index.php?title=SPSS&oldid=822286593>
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**FACULTY OF SCIENCE**

**Syllabus**

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Bioinformatics Project (BI-601)

Course (Paper) Unique Code: 1603 2200 0106 0100

External Exam Time Duration: 2 Hours and 30 minutes

<b>Name of Program</b>	<b>Semester</b>	<b>Course Group</b>	<b>Credit</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Practical /Viva Marks</b>	<b>Total Marks</b>
Bachelor of Science	06	Core	24	225	--	525	750

Course Objective:

- To do research on any areas of Bioinformatics

**COURSE STRUCTURE FOR UG PROGRAMME  
BIOINFORMATICS- 601  
SEMESTER- VI**

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
VI	BI-601 (Practical)	Bioinformatics Project	40	24	One day per batch	225	525	750
Total credits				24	Total marks			750

**General instructions**

1. The medium of instruction will be English for theory and practical courses
2. There will be 40 practical lecture / week / semester.
3. Each lecture will be of 55 mins.
4. This Bioinformatics Project Work marks Carries total 750 marks, among that 225 marks are internal and 525 marks are external



**SKELETON OF BIOINFORMATICS PROJECT VIVAEXAMINATION PAPER -  
EXTERNAL  
(SEMESTER- VI)**

Subject code	Subject	Internal	Maximum Marks			
			External			
Project			Project Report	Presentation	Viva	Total
BI-601 (Practical)	Bioinformatics Project	225	175	175	175	<b>750</b>

**SKELETON OF BIOINFORMATICS PROJECT EXAMINATION PAPER -  
INTERNAL  
(SEMESTER- VI)**

**Project Internal Marks:** Total = 225 Marks

S.No	Subject	Max. Mark
1	Monthly Report (4 Months X 30 Marks)	120
2	Seminar (Review Article)	25
3	Seminar – Research work (Mid Term – After 2 Months of work)	25
4	Seminar – Research work (Preliminary Exam - After 4 Months of work)	25
5	Attendance	15
6	Discipline and involvement in the Project	15
	<b>Total &gt;&gt;</b>	<b>225</b>

**General Instructions**

Students need to do Bioinformatics research work and submit the report in the prescribed format. Also, they need to present their work in the external examination.

## **BI.601 Bioinformatics Project (Practical)**

Students need to do Bioinformatics research work and submit the report in the prescribed format. Also, they need to present their work in the external examination.