

SAURASHTRA UNIVERSITY, RAJKOT



Accredited Grade “A” by NAAC (CGPA 3.05)

COURSE STRUCTURE & SYLLABUS

FOR

UNDERGRADUATE PROGRAMME

IN

BIOINFORMATICS

(Faculty of Science)

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

Effective from June - 2016

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	01	Core	Communicative English - I	BI-101	4	30	70	50	150	1603 2200 0101 0100
02	UG	01	Core	Mathematics and Statistics- I	BI-102	5	30	70	50	150	1603 2200 0101 0200
03	UG	01	Core	Introduction to Computer Programming	BI-103	5	30	70	50	150	1603 2200 0101 0300
04	UG	01	Core	Fundamentals of Biochemistry and Biophysics	BI-104	5	30	70	50	150	1603 2200 0101 0400
05	UG	01	Core	Basics in Microbiology	BI-105	5	30	70	50	150	1603 2200 0101 0500
06	UG	02	Core	Communicative English – II	BI-201	4	30	70	50	150	1603 2200 0102 0100
07	UG	02	Core	Mathematics and Statistics - II	BI-202	5	30	70	50	150	1603 2200 0102 0200
08	UG	02	Core	Introduction to Bioinformatics	BI-203	5	30	70	50	150	1603 2200 0102 0300
09	UG	02	Core	Cell & Molecular Biology	BI-204	5	30	70	50	150	1603 2200 0102 0400
10	UG	02	Core	Molecular and Developmental Genetics	BI-205	5	30	70	50	150	1603 2200 0102 0500

**SKELETON OF COMPLETE COURSE CONTENT OF
UNDER GRADUATE BIOINFORMATICS
SEMESTER I & II**

SEMESTER	PAPER NO. & CODE	TITLE OF THE PAPER	CREDIT
I	BI-101 (Theory)	Communicative English - I	3
	BI-101 (Practical)	-do-	1
	BI-102(Theory)	Mathematics and Statistics- I	3
	BI-102(Practical)	-do-	2
	BI-103(Theory)	Introduction to Computer Programming	3
	BI-103(Practical)	-do-	2
	BI-104(Theory)	Fundamentals of Biochemistry and Biophysics	3
	BI-104(Practical)	-do-	2
	BI-105(Theory)	Basics in Microbiology	3
	BI-105(Practical)	-do-	2
II	BI-201(Theory)	Communicative English – II	3
	BI-201(Practical)	-do-	1
	BI-202(Theory)	Mathematics and Statistics - II	3
	BI-202(Practical)	-do-	2
	BI-203(Theory)	Introduction to Bioinformatics	3
	BI-203(Practical)	-do-	2
	BI-204(Theory)	Cell & Molecular Biology	3
	BI-204(Practical)	-do-	2
	BI-205(Theory)	Molecular and Developmental Genetics	3
	BI-205(Practical)	-do-	2

FACULTY OF SCIENCE

Syllabus

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Communicative English - I(BI-101)

Course (Paper) Unique Code: 1603 2200 0101 0100

External Exam Time Duration: 2 Hours and 30 minutes

Name of Program	Semester	Course Group	Credit	Internal Marks	External Marks	Practical /Viva Marks	Total Marks
Bachelor of Science	01	Core	4	30	70	50	150

Course Objective:

- To uncover basic English grammar, conversational English and Foreign language test (IELTS & TOEFL)

**COURSE STRUCTURE FOR UG PROGRAMME
BIOINFORMATICS- 101
SEMESTER- I**

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
I	BI-101 (Theory)	Communicative English - I	4	3	2.5hrs	30	70	100
I	BI-101 (Practical)	Communicative English - I	2	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 4 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 2 periods
5. Each semester theory paper will be of “four” 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 – I)

SECTION – I		Marks – 20	
Ques. 1 Attempt the following Multiple Choice Questions in the given time period (The questions will be of Justification based MCQ, each carrying one mark. All the units will be covered in this section.)			
SECTION – II		Marks – 50	
Ques.1	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 Marks
Ques.2	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 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.101 Communicative English - 1
(Theory)

UNIT 1: (15 Marks)

- Parts of speech and their uses (A detailed Study)
- Articles and their uses
- Preposition
- Tenses and their Uses

Conversational English (35 Marks)

UNIT II: Conversational English: Introduction

- Meeting people, Exchanging Greetings and Taking Leave
- Introducing yourself
- Introducing people to others
- Giving personal information
- Talking about people, Animals, Places

UNIT III: Conversational English: Talking and describing about

- Future Events
- Likes and dislikes
- Expressing Hopes, wishes/ concerns
- Expressing Sympathy/ Condolences
- Invitation/Permission
- Apology/Requests/Congratulating

UNIT IV: IELTS & TOEFL (20 Marks)

- Similarities & Differences: IELTS & TOEFL
- British and American terms (Minimum 250 terms)
- Speaking, Writing, Listening and Reading

BI.101 Communicative English - 1
(Practical)

Based on theory syllabus

References

1. Geoffrey Leech, Margaret Deushar. *English Grammar Today*.
2. W. S. Allen. *Living English Structure*.
3. F. T. Wood. *A Remedial English Grammar for Foreign Students*.
4. P. C. Wren and H. Martin. *Highschool English Grammar and Composition*. S. Chand company Mumbai, 2006.
5. Thomson and Martinet. *A Practical English Grammar*. OUP, 1986.
6. <http://www.oxforddictionaries.com/words/british-and-american-terms>
7. <http://www.ielts.org/>
8. <https://www.britishcouncil.in/exam/ielts>
9. <https://www.ieltsidpindia.com/>
10. <http://www.ielts-exam.net/>
11. <http://www.ets.org/toefl/>
12. <http://www.toeflgoanywhere.org/>

FACULTY OF SCIENCE

Syllabus

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Mathematics and Statistics - I (BI-102)

Course (Paper) Unique Code: 1603 2200 0101 0200

External Exam Time Duration: 2 Hours and 30 minutes

Name of Program	Semester	Course Group	Credit	Internal Marks	External Marks	Practical /Viva Marks	Total Marks
Bachelor of Science	01	Core	5	30	70	50	150

Course Objective:

- To understand basic mathematics and statistics which is needed for Bioinformatics applications

**COURSE STRUCTURE FOR UG PROGRAMME
BIOINFORMATICS- 102
SEMESTER- I**

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
I	BI-102 (Theory)	Mathematics and Statistics - I	5	3	2.5hrs	30	70	100
I	BI-102 (Practical)	Mathematics and Statistics - I	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 – I)**

SECTION – I		Marks – 20	
<p>Ques. 1 Attempt the following Multiple Choice Questions in the given time period</p> <p>(The questions will be of Justification based MCQ, each carrying one mark. All the units will be covered in this section.)</p>			
SECTION – II		Marks – 50	
Ques.1	Answer specifically- (attempt any three out of six)	Units 1 to 4	3x2= 6 Marks
	Short Questions - (attempt any three out of six)	Units 1 to 4	3x3= 9 Marks
	Answer in detail – (attempt any two out of five)	Units 1 to 4	5x2= 10 Marks
Ques.2	Answer specifically- (attempt any three out of six)	Units 1 to 4	3x2= 6 Marks
	Short Questions - (attempt any three out of six)	Units 1 to 4	3x3= 9 Marks
	Answer in detail – (attempt any two out of five)	Units 1 to 4	5x2= 10 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.102 Mathematics and Statistics- I

(Theory)

UNIT 1: Complex Numbers & Set

- Definition, real and imaginary parts, equality of two complex numbers, Conjugate of a complex number, Modulus of a complex number
- Argand Diagram (geometrical representation of a complex number)
- Algebra of complex numbers, integral powers of 'i', Polar form of a complex number, square root of complex number
- De Moivre's theorem (without proof)
- Sets- Definition, Types of Sets, Subsets
- Complement of Sets, union and Intersection of Sets, Difference of Sets
- Demorgan's Law
- Cartesian product of Sets

UNIT 2: Matrices and Determinants

- Matrix Algebra- Types of matrices, Equality of Matrices,
- Operations on Matrices-Addition, Subtraction, Scalar multiplication, multiplication of two matrices, and their properties, Transpose, symmetric and skew symmetric matrices
- Determinants- evaluation of 2x2, 3x3 determinants
- Properties of determinants, minors and cofactors, adjoint of a matrix, singular and non singular matrices, inverse of a matrix
- Solution of a system of linear equations by Cramer's rule and by matrix inversion method

UNIT 3: Differential calculus

- Limits, standard limits (without proof)
- Differentiation
- Standard derivatives
- Product rule, Quotient rule, Chain rule, derivatives of implicit functions and Parametric functions
- Logarithmic differentiation, Higher order derivatives

UNIT 4: Statistics-Introduction

- Introduction to Statistics, Function of Statistics, scope of Statistics, Limitation of Statistics
- Classification and tabulation of Data-Introduction, Objectives of classification, Types of classification, Formation of Frequency distribution, Tabulation of data, Role of tabulation, Parts of Table, Types of Tables
- Diagrammatic and graphic Presentation-Introduction, significance of diagrams and graphs, Types of Diagram, Graphs of Frequency Distribution, Limitation of Diagrams and Graphs

UNIT 5: Measure of Central Tendency

- Introduction to Central Tendency
- Objective of central tendency, Requisites of a good averages
- Types of Averages (Arithmetic Mean, Median, Mode)
- Measures of Dispersion-Introduction, Significance of measuring variations
- Methods of Studying Variation, Range, Mean Deviation, Standard Deviation, Variance, coefficient of Variation

BI.102 Mathematics and Statistics- I
(Practical)

Based on theory syllabus

Reference Books:

- Erwin Kreysig, Engineering Mathematics, John Wiley, 7th Edition, 2001.
- Manicavachagom Pillay and Natarajan, A text book of Analytical Geometry, ViswanathanPvt. Ltd,1983.
- Narayanan Manicavachagom Pillay, Calculus Vol I, S. Viswanathan Publications.

Annexure – “C”

FACULTY OF SCIENCE

Syllabus

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Introduction to Computer Programming (BI-103)

Course (Paper) Unique Code: 1603 2200 0101 0300

External Exam Time Duration: 2 Hours and 30 minutes

Name of Program	Semester	Course Group	Credit	Internal Marks	External Marks	Practical /Viva Marks	Total Marks
Bachelor of Science	01	Core	5	30	70	50	150

Course Objective:

- To understand basic of Computer (related to Hardware, Software and Operating systems) which is needed for Bioinformatics applications

**COURSE STRUCTURE FOR UG PROGRAMME
BIOINFORMATICS- 103
SEMESTER- I**

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
I	BI-103 (Theory)	Introduction to Computer Programming	5	3	2.5hrs	30	70	100
I	BI-103 (Practical)	Introduction to Computer Programming	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 – I)**

SECTION – I		Marks – 20	
<p>Ques. 1 Attempt the following Multiple Choice Questions in the given time period</p> <p>(The questions will be of Justification based MCQ, each carrying one mark. All the units will be covered in this section.)</p>			
SECTION – II		Marks – 50	
Ques.1	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 Marks
Ques.2	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 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.103 Introduction to Computer Programming **(Theory)**

UNIT 1: Basic computer organization

- Definition & Block diagram of Computer
- History of computers, evolution and generation of computers
- Classification of computers
- Input Devices: Keyboard, mouse, joystick, scanners, digital camera, bar code reader, touch Screen, Speech input device (microphone)
- Output Devices: Monitor, Speaker & Printer
- Computer data storage: Primary, Secondary & tertiary. Characteristics of storage
- Type of Memory:RAM, ROM, PROM, EPROM, EEPROM, Cache memory, virtual memory, flash memory
- Storage Devices: Magnetic, Optical & flash memory
- Biocomputing

UNIT 2: Computer software

- What is software
- relationship between hardware and software
- Types of software
- Acquiring software
- firmware
- Planning computer program: Algorithm and Flow chart
- Computer languages: High level & low level languages, assembling languages, compiler, interpreter, assembler

UNIT3: Operating systems

- Definition, functions and evolution
- Types of Operating System
- Examples of OS: Windows, Unix/Linux, Irix, Solaris, Mac
- Structure and Functions of Server
- Types of server

UNIT 4: Internet Organization and Architecture

- Internet & Intranet
- Internet Applications & Services
- Types of Networks
- Internet Protocols
- Types of Internet Connections
- Browsers, WWW, HTTP, FTP
- Internet addressing: IP address, domain name, URL, Hypertext
- Blue tooth, WiFi& Fire wall
- Computer Viruses

UNIT 5: Introduction to UNIX

- Introduction, architecture, features, types of shell
- UNIX file system and related Commands
- UNIX file system overview, types of files (ordinary files, directory files, device files, Unix files)
- Commands and Operation of UNIX
- UNIX filenames and file protections
- UNIX commands for working with directories
- I/O redirection and piping
- Repeating functions loops and IF statements

BI.103 Introduction to Computer Programming **(Practical)**

Based on theory syllabus (MS Office and OS-Windows, Linux, Unix)

Reference Books:

- Computer Fundamentals: P. K Sinha- BP publications
- Computers Today: Alexis Leon and Mathews Leon- Leon Vikas
- Computer Fundamentals: V. Rajaraman
- Fundamentals of Information Technology: Alexis and Mathews- Leon Vikas
- Learning Computer Fundamentals: Ramesh Bangra- Khanna Book Publishers
- Silberschatz, Galvin, Gagne: Operating System Concepts, 7th Edition
- UNIX Shell Programming, YashwantKanetkar, BPB Publication

FACULTY OF SCIENCE

Syllabus

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Fundamentals of Biochemistry and Biophysics (BI-104)

Course (Paper) Unique Code: 1603 2200 0101 0400

External Exam Time Duration: 2 Hours and 30 minutes

Name of Program	Semester	Course Group	Credit	Internal Marks	External Marks	Practical /Viva Marks	Total Marks
Bachelor of Science	01	Core	5	30	70	50	150

Course Objective:

- To understand the structure, function and inter-relationships of biomolecules with the perspective of life

**COURSE STRUCTURE FOR UG PROGRAMME
BIOINFORMATICS- 104
SEMESTER- I**

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
I	BI-104 (Theory)	Fundamentals of Biochemistry and Biophysics	5	3	2.5hrs	30	70	100
I	BI-104 (Practical)	Fundamentals of Biochemistry and Biophysics	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 – I)**

SECTION – I		Marks – 20	
<p>Ques. 1 Attempt the following Multiple Choice Questions in the given time period</p> <p>(The questions will be of Justification based MCQ, each carrying one mark. All the units will be covered in this section.)</p>			
SECTION – II		Marks – 50	
Ques.1	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 Marks
Ques.2	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 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.104 Fundamentals of Biochemistry and Biophysics **(Theory)**

UNIT 1: Basics of Biomolecules

- Main constituents of Biomolecules (C, H, N, O, S, P), Properties of water, concept of Buffer and pH
- Thermodynamics
- Chemical Bonds and Chemical interactions in Biomolecules: Phosphodiester, glycosidic, peptide, disulphide, ionic, covalent, polar, non-polar, hydrogen bonds and Vander Waals interactions
- Overview of Biological Macromolecules
- Vitamins and Minerals
- Principles of Bioenergetics and High Energy molecules

UNIT 2: Enzymes

- Enzymes: Definition, Nomenclature & Classification
- Properties and Functions of Enzymes
- coenzymes and metal cofactors
- mechanism of enzyme action
- Enzyme kinetics: Michaelis –Menton equation
- Regulation of Enzyme activity. temperature and pH effects, inhibitors and activators, active site

UNIT 3: Carbohydrate and Lipid

- Carbohydrates -Classification, Structure and Functions
- Carbohydrate metabolism: Glycolysis, Krebs cycle, Gluconeogenesis, ETC & Oxidative phosphorylation, Photophosphorylation.
- Lipids- Classification, Structure and Functions
- Oxidation of fatty acids

UNIT 4: Nucleic Acid and Protein

- Proteins: Composition and function
- Amino acids: classes and structure, properties
- Oxidation of amino acids
- Nucleic acids: Classification, Structure and Functions
- Purine & Pyrimidine synthesis

UNIT 5: Protein and Nucleic Acid Structure

- Protein primary structure & determination (Sanger's method, Edman's method, Dansyl chloride, Dabsyl chloride), forces stabilizing secondary structure, tertiary Structure, Quaternary structure
- Nucleic acid structure: The chemical structure (Double helical structure, Polymorphism, DNA super coiling and unusual DNA)
- Association of macromolecules
- Techniques to study Biomolecules: Sedimentation, Light scattering, small angle X-ray Scattering.

BI.104 Fundamentals of Biochemistry and Biophysics (Practical)

Based on theory syllabus

Reference Books:

- S.C. Rastogi, Biochemistry, Tata McGraw Hill publishing limited, 1996.
- R.K.Murray, D.K.Granner, P.A.Mayes and V.W.Rodwell, Harper's Biochemistry, McGraw hill companies, 2000.
- Fundamentals of (1999) by BiochemistryDonald Voet, Judith G Voet and Charlotte W Pratt, John Wiley & Sons, NY.
- Biochemistry III ed (1994) by Lubert Stryer, WH Freeman and Co., San Francisco.
- Outlines of Biochemistry (1987) by Eric E Conn, P K Stumpf, G Bruening and Ray H Doi, John Wiley & Sons, NY.
- Principles of Biochemistry General Aspects 1983 Smith etal. (McGraw Hills)

FACULTY OF SCIENCE

Syllabus

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Basics in Microbiology (BI-105)

Course (Paper) Unique Code: 1603 2200 0101 0500

External Exam Time Duration: 2 Hours and 30 minutes

Name of Program	Semester	Course Group	Credit	Internal Marks	External Marks	Practical /Viva Marks	Total Marks
Bachelor of Science	01	Core	5	30	70	50	150

Course Objective:

- To understand the structure, function and its pathogenicity of microbes with the perspective of life

**COURSE STRUCTURE FOR UG PROGRAMME
BIOINFORMATICS- 105
SEMESTER- I**

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
I	BI-105 (Theory)	Basics in Microbiology	5	3	2.5hrs	30	70	100
I	BI-105 (Practical)	Basics in Microbiology	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 – I)

SECTION – I		Marks – 20	
Ques. 1 Attempt the following Multiple Choice Questions in the given time period (The questions will be of Justification based MCQ, each carrying one mark. All the units will be covered in this section.)			
SECTION – II		Marks – 50	
Ques.1	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 Marks
Ques.2	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 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.105 Basics in Microbiology **(Theory)**

UNIT 1

- History and scope of Microbiology
- Molecular Taxonomy and Classification of Microorganisms
- Ultra structure of Bacteria, Fungi, Algae, Protozoa and Viruses
- Current methods of Microbial identification
- Basic concepts of Microscopy and its types

UNIT 2

- Microbial growth: Different phases and kinetics
- Types of media for growth of microorganism in the laboratory
- Cultivation, propagation and preservation of micro organisms and pathogens
- Handling of micro organisms and pathogens
- Sterilization techniques: Physical and chemical agents

UNIT 3

- Characteristics of Antibiotics and their mode of action
- MDR- Mechanism, MDR protein Classification
- Microbial diseases: Hepatitis, Polio, Leprosy, Filariasis
- Microbial toxins

UNIT 4

- Industrially important microbes
- Dairy and food microbiology
- Fermentation technology; Fermentation of Ethanol and vitamins
- Microbial Secondary metabolites
- Biofertilizers, Biopesticides and Bioremediation

UNIT 5

- Biology of *Bacteriophages*, *H. Influenza*
- Biology of *Escherichia coli*, *Salmonella sp*
- Biology of *Bacillus thuringiensis*, *Streptomyces sp*
- Biology of Penicillium, Helicobacter
- Single celled Eukaryote: *Saccharomyces cerevisiae*

BI.105 Basics in Microbiology **(Practical)**

Based on theory syllabus

Reference Books:

- Microbiology- M.J. Pelczar, Jr., E.C.S. Chang and N.R. Krieg, McGraw Hill Company, Newyork (1986).
- Microbiology-concepts and applications, M.J. Pelczar, Jr., E.C.S. Chang and N.R. Krieg, McGraw Hill Company (1993).
- Microbiology – L.M. Prescott, J.P. Hareley D.A. Klein – Wm.c. Brown publishers. Dutique, Jawa, Melbourne. 1993.
- Modern Microbiology – wayne w. Umbreit – W.H, Freeman and company, son francislcod London (1962).
- Basic and Practical Microbiology – Ronald M. Atlas, Mac.Milleen Company, Newyork (1986)

FACULTY OF SCIENCE

Syllabus

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Communicative English - II(BI-201)

Course (Paper) Unique Code: 161603 22000102 0100

External Exam Time Duration: 2 Hours and 30 minutes

Name of Program	Semester	Course Group	Credit	Internal Marks	External Marks	Practical /Viva Marks	Total Marks
Bachelor of Science	01	Core	4	30	70	50	150

Course Objective:

- To uncover basic English grammar, conversational English and Vocabulary /Idioms

**COURSE STRUCTURE FOR UG PROGRAMME
BIOINFORMATICS- 201
SEMESTER- II**

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
I	BI-201 (Theory)	Communicative English - II	4	3	2.5hrs	30	70	100
I	BI-201 (Practical)	Communicative English - II	2	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 4 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 2 periods
5. Each semester theory paper will be of “four” 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 – II)**

SECTION – I		Marks – 20	
<p>Ques. 1 Attempt the following Multiple Choice Questions in the given time period</p> <p>(The questions will be of Justification based MCQ, each carrying one mark. All the units will be covered in this section.)</p>			
SECTION – II		Marks – 50	
Ques.1	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 Marks
Ques.2	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 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.201 Communicative English - II

(Theory)

UNIT I: Grammar Topics(15 Marks)

- Modal Auxiliaries
- Active and Passive
- Idioms and Phrases
- Degree

Conversational English (55 Marks)

UNIT II: Conversational English: Tele-manners

- Asking for someone
- Dealing with wrong numbers
- Taking and Leaving Messages
- Making Inquiries
- Calling for Help in an Emergency

UNIT III: Conversational English: Situational Dialogues at various places like...

- At the Bank
- At the Railway Station/Airport
- At an Office
- At a hotel
- At the Library

UNIT IV: Conversational English: Vocabulary /Idioms

- Common idioms and phrases
- Idioms and phrases from Science and Technology
- Word Power: How to talk about science and scientists (From Word Power Made Easy by Norman Lewis: Sessions 11–13)
- Inaccurate, misleading, misused, ambiguous, and logically confused words and phrases in Psychology, Science and Technology

BI.201 Communicative English – II (Practical)

Based on theory syllabus

References

1. Spoken English: A Foundation Course by KamleshSadanand and SusheelaPunitha (Part I and Part II)
2. Telephoning in English Third Edition by B. Jean NateropeAbd Rod Revell
3. Word Power Made Easy by Norman Lewis (Sessions 11–13)
4. Lilienfeld SO, Sauvigné KC, Lynn SJ, Cautin RL, Latzman RD, Waldman ID. Fifty psychological and psychiatric terms to avoid: a list of inaccurate, misleading, misused, ambiguous, and logically confused words and phrases. *Front Psychol.* 2015 Aug 3;6:1100. doi: 10.3389/fpsyg.2015.01100. eCollection 2015. Review. PubMed PMID: 26284019; PubMed Central PMCID: PMC4522609.

FACULTY OF SCIENCE

Syllabus

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Mathematics and Statistics - II(BI-202)

Course (Paper) Unique Code: 1603 2200 0102 0200

External Exam Time Duration: 2 Hours and 30 minutes

Name of Program	Semester	Course Group	Credit	Internal Marks	External Marks	Practical /Viva Marks	Total Marks
Bachelor of Science	01	Core	5	30	70	50	150

Course Objective:

- To understand basic mathematics and statistics which is needed for Bioinformatics applications

COURSE STRUCTURE FOR UG PROGRAMME
BIOINFORMATICS- 202
SEMESTER- II

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
I	BI-202 (Theory)	Mathematics and Statistics - II	5	3	2.5hrs	30	70	100
I	BI-202 (Practical)	Mathematics and Statistics - II	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 – II)**

SECTION – I		Marks – 20	
<p>Ques. 1 Attempt the following Multiple Choice Questions in the given time period</p> <p>(The questions will be of Justification based MCQ, each carrying one mark. All the units will be covered in this section.)</p>			
SECTION – II		Marks – 50	
Ques.1	Answer specifically- (attempt any three out of six)	Units 1 to 4	3x2= 6 Marks
	Short Questions - (attempt any three out of six)	Units 1 to 4	3x3= 9 Marks
	Answer in detail – (attempt any two out of five)	Units 1 to 4	5x2= 10 Marks
Ques.2	Answer specifically- (attempt any three out of six)	Units 1 to 4	3x2= 6 Marks
	Short Questions - (attempt any three out of six)	Units 1 to 4	3x3= 9 Marks
	Answer in detail – (attempt any two out of five)	Units 1 to 4	5x2= 10 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.202 Mathematics and Statistics –II

(Theory)**UNIT 1: Applications of derivatives and partial differentiation**

- Rolle's theorem
- Lagrange's mean value theorem
- Taylor's theorem, Maclaurin's theorem (all without proof).
- Increasing and decreasing functions, maxima and minima.
- Functions of two or more variables, partial derivatives of first and second order.

UNIT 2: Integral calculus

- Integral as anti derivatives, standard integrals,
- Methods of integration by substitution, integration by parts
- Some special integrals: $\int \frac{dx}{x^2 + a^2}$, $\int \frac{dx}{x^2 - a^2}$, $\int \frac{dx}{\sqrt{x^2 + a^2}}$,

$$\int \frac{dx}{\sqrt{x^2 - a^2}} , \int \frac{dx}{\sqrt{a^2 - x^2}}$$

- Integration by partial fraction, definite integrals, properties of definite integrals

UNIT 3: Vectors and Analytical Geometry

- Scalars and Vectors-Basic definitions
- Operations-addition, scalar product, vector product, scalar triple product, vector triple product and their properties.
- Vector differential operator, gradient, divergence and curl.
- Cartesian Coordinate system
- Distance formula, section formula, midpoint formula
- Area of a triangle, collinear points, slope, shifting of origin
- Equations of straight lines – slope intercept form, slope point form,
- Two-point form, intercept form and general form, equation of circles, centre and radius

UNIT 4: Correlation and Regression Analysis

- Introduction, significance of the study of correlation
- Types of correlation, methods of studying correlation (scatter diagram method, Karl Pearson's coefficient of correlation, spearman's rank coefficient of correlation)
- Probable error of coefficient of correlation
- Regression Analysis- Introduction, significance of the study of regression
- Difference between correlation and regression analysis, Regression Equation

UNIT 5: Probability

- Introduction, probability approach
- terms used in probability
- Theorem of probability (addition theorem, Multiplication Theorem)
- Conditional probability, Mathematical Expectation
- Probability distribution- Introduction, binomial distribution, Poisson distribution, Normal distribution

BI.202 Mathematics and Statistics –II

(Practical)

Based on theory syllabus

References:

- Erwin Kreysig, Engineering Mathematics, John Wiley, 7th Edition, 2001.
- Manicavachagom Pillay and Natarajan, A text book of Analytical Geometry, Viswanathan Pvt. Ltd, 1983.
- Narayanan Manicavachagom Pillay, Calculus Vol I, S. Viswanathan Publications.

Annexure – “C”

FACULTY OF SCIENCE

Syllabus

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Introduction to Bioinformatics(BI-203)

Course (Paper) Unique Code: 1603 2200 0102 0300

External Exam Time Duration: 2 Hours and 30 minutes

Name of Program	Semester	Course Group	Credit	Internal Marks	External Marks	Practical /Viva Marks	Total Marks
Bachelor of Science	01	Core	5	30	70	50	150

Course Objective:

- To understand basic of Bioinformatics and its related fields

**COURSE STRUCTURE FOR UG PROGRAMME
BIOINFORMATICS- 203
SEMESTER- II**

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
I	BI-203 (Theory)	Introduction to Bioinformatics	5	3	2.5hrs	30	70	100
I	BI-203 (Practical)	Introduction to Bioinformatics	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 – II)

SECTION – I		Marks – 20	
Ques. 1 Attempt the following Multiple Choice Questions in the given time period (The questions will be of Justification based MCQ, each carrying one mark. All the units will be covered in this section.)			
SECTION – II		Marks – 50	
Ques.1	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 Marks
Ques.2	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 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.201Introduction to Bioinformatics

(Theory)

Unit – I

- Genome projects
- Related disciplines of Bioinformatics (Branches of Bioinformatics)
- Nature of Biological data
- Use of Databases in Biological Discovery
- Major Bioinformatics Resources: NCBI, EBI, ExPASy, RCSB, JCVI, SANGER, etc..

Unit – II

- Primary Sequence Databases - nucleic acid and protein
- Secondary databases
- Protein three dimensional databases & visualization tools
- Database search tool: Entrez and SRS

Unit III

- Basic concepts and need of sequence alignment
- Basic terminologies: motifs, fingerprints, domains, family, superfamily, profile, matrix, fold, Identity, similarity, positives, score, etc..
- Sequence comparison methods: Dot matrix and Dynamic Programming
- Sequence comparison scoring systems: PAM and BLOSUM family of matrices

Unit –IV

- Pairwise & Multiple sequence alignment
- Basics of Database similarity searching
- Sequence database similarity searching algorithms (BLAST & FASTA programs)

Unit V

- Phylogenetic analysis – Overview
- Relation with multiple sequence alignment
- Phylogenetic tree: topology & branch length
- Overview of methods available for Phylogenetic Analysis

BI.201 Introduction to Bioinformatics (Practical)

Based on theory syllabus

References:

- Web resources
- Arthur M. Lesk, Introduction to Bioinformatics, Oxford University Press, New Delhi, 2003.
- David W. Mount, Bioinformatics – Sequence and Genome analysis, Cold Spring Harbor Laboratory Press, New York, 2001.
- G. Gibson & S.V. Muse, A Primer of Genome Science, Sinauer Associates, Inc. Publishers, 2002.
- A. Baxevanis and B.F. Ouellette. Bioinformatics: A practical Guide to the Analysis of Genes and Proteins, Wiley- Interscience, Hoboken, NJ, 2005.
- A. M. Campbell & L. J. Heyer, Discovering Genomics, Proteomics & Bioinformatics, CSHL Press, 2003.
- S.R. Pennington & M.J. Dunn, Proteomics – from protein sequence to function, BIOS Scientific Publishers, 2002.

Annexure – “C”

FACULTY OF SCIENCE

Syllabus

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Cell & Molecular Biology(BI-204)

Course (Paper) Unique Code: 1603 2200 0102 0400

External Exam Time Duration: 2 Hours and 30 minutes

Name of Program	Semester	Course Group	Credit	Internal Marks	External Marks	Practical /Viva Marks	Total Marks
Bachelor of Science	01	Core	5	30	70	50	150

Course Objective:

- To understand basic Cell, organelles and its function

COURSE STRUCTURE FOR UG PROGRAMME
BIOINFORMATICS- 204
SEMESTER- II

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
I	BI-204 (Theory)	Cell & Molecular Biology	5	3	2.5hrs	30	70	100
I	BI-204 (Practical)	Cell & Molecular Biology	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 – II)**

SECTION – I		Marks – 20	
<p>Ques. 1 Attempt the following Multiple Choice Questions in the given time period</p> <p>(The questions will be of Justification based MCQ, each carrying one mark. All the units will be covered in this section.)</p>			
SECTION – II		Marks – 50	
Ques.1	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 Marks
Ques.2	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 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.204: Cell & Molecular Biology **(Theory)**

UNIT 1

- Cell theory, Diversity of cell size and shape, composition of cell
- Structure of Prokaryotic and Eukaryotic cells
- Cell organelles – Structure and function: Nucleus and Nucleolus, Golgi complex, Endoplasmic Reticulum, Ribosomes, Mitochondria, Plastids, Lysosomes, Microbodies – Peroxisome&Glyoxysome
- Cell motility: cilia, flagella
- Structure of cell wall and cell membrane

UNIT 2

- Chromosomes structure & Organization of DNA in Prokaryotes and Eukaryotes; spatial arrangement of histones, solenoid model of nucleosomes, Loops. Domains and scaffolds in chromatin. Repetitive and unique DNA sequences: Chromosomal DNA contents and C-value paradox.
- Special types of chromosomes - Polytene chromosomes and lamp brush chromosome
- Cell cycle and its regulation cell cycle Cell-Cell Interaction; Cell adhesion molecules, Cellular junctions, Extracellular matrix
- Cell senescence and death

UNIT 3

- Central dogma in molecular Biology
- Different forms of DNA
- Properties of DNA; denaturation and renaturation
- DNA replication – enzymes involved in replication, replication models
- DNA damage and repair

UNIT 4

- RNA and its types
- Transcription in prokaryotes & eukaryotes: RNA polymerases & Post transcriptional modifications
- The genetic code - specificity, redundancy and wobble hypothesis
- Translation in prokaryotes & eukaryotes; Ribosomes – Structure and function, Post translational modifications

UNIT 5

- Regulation of Gene expression; Operons – positive & negative regulation, Control sequences; promotor, operator, terminator and attenuator.
- Transposable elements: Types and mechanism
- Cancer Biology.

BI.204: Cell & Molecular Biology (Practical)

Based on theory syllabus

Reference Books:

- Cell Biology – Rastogi (2008)
- D.P. and Robertis, E.M.F. (2011). Cell and Molecular biology. 8th Edition. New York: Lippincott Williams & Wilkins.
- Alberts B, Johnson A, Lewis J, et al. Molecular Biology of the Cell. 6th edition (2014). New York: Garland Science.
- Lodish, H., Baltimore, D. Berk, A., Zipursky, S. L. Matsudaira, P. and Darnell. J, molecular Cell Biology, 7th edition, W. H. Freeman and Company, New York.
- Stent, G. S. and Calender, R. Molecular Genetics 1986. An Introductive Narrative, CBS Publishers and Distributors, New Delhi.
- Weaver, R. E and Hedrick, P. W. 1985 Basic Genetics, W. M. C. Brown Publishers.
- Maloy, S. R., Gonan. J. E. Jr., & Friefelder, D. 1994. Microbial Genetics, Second Edition Jonas &Barlett Publishers, Boston, London.
- Lewin, B. 1997 Genes 1997 Oxford University Press, Oxford, New York, Tokyo. Latest Edition.

Annexure – “C”

FACULTY OF SCIENCE

Syllabus

Subject: **BIOINFORMATICS**

Course (Paper) Name & No.: Molecular and Developmental Genetics(BI-205)

Course (Paper) Unique Code: 1603 2200 0102 0500

External Exam Time Duration: 2 Hours and 30 minutes

Name of Program	Semester	Course Group	Credit	Internal Marks	External Marks	Practical /Viva Marks	Total Marks
Bachelor of Science	01	Core	5	30	70	50	150

Course Objective:

- To understand Molecular biology and developmental biology at molecular level

COURSE STRUCTURE FOR UG PROGRAMME
BIOINFORMATICS- 205
SEMESTER- II

Semester	Course	Title	Hours /week	Credit	Exam duration	Internal marks	External marks	Total marks
I	BI-205 (Theory)	Molecular and Developmental Genetics	5	3	2.5hrs	30	70	100
I	BI-205 (Practical)	Molecular and Developmental Genetics	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 – II)**

SECTION – I		Marks – 20	
<p>Ques. 1 Attempt the following Multiple Choice Questions in the given time period</p> <p>(The questions will be of Justification based MCQ, each carrying one mark. All the units will be covered in this section.)</p>			
SECTION – II		Marks – 50	
Ques.1	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 Marks
Ques.2	Answer specifically- (attempt any three out of six) Short Questions - (attempt any three out of six) Answer in detail – (attempt any two out of five)	Units 1 to 4 Units 1 to 4 Units 1 to 4	3x2= 6 Marks 3x3= 9 Marks 5x2= 10 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.205 Molecular and Developmental Genetics **(Theory)**

UNIT 1

- Gene as the unit of mutation and recombination.
- Identification of DNA as the genetic material.
- Mutations; molecular nature; mutagenesis by nitrous acid, hydroxyl amine, alkylating agents, intercalaters and UV; origin of spontaneous mutations and control.
- Gene as the unit of expression, co-linearity of gene and polypeptide.

UNIT 2

- Introduction to Genetics- Mendelism, Mendelian principles and his experiments
- Gene interactions - incomplete dominance -Mirabilis, co-dominance-coat colour in cattle,
- lethal genes - Albinism and coat colour in mice, Interaction of genes-comb pattern in poultry, Epistasis- fruit colour in summer squashes

UNIT 3

- Microbial genetics- Transformation, Conjugation, Transduction and Sexduction
- Eukaryotic genetics- Linkage & Crossing over
- Sex determination – Sex limited and sex-linked inheritance
- Population genetics; Hardy-Weinberg equilibrium, gene and genotypic frequencies.

UNIT 4

- Extrachromosomal Inheritance-Mitochondrial and chloroplast genetic systems.
- Cell Signaling
- Cell-cell communication in development
- Developmental genetics-*Drosophila*

UNIT 5

- Maternal genes and formation of body axes
- Segmentation genes
- Homeotic genes function
- Environmental regulation of animal development

BI.205 Molecular and Developmental Genetics (Practical)

Based on theory syllabus

Reference Books:

- D.P. and Robertis, E.M.F. (2011). Cell and Molecular biology. 8th Edition. New York: Lippincott Williams & Wilkins.
- Gardner, Simmons, Snustad. (2006). Principles of Genetics. John Wiley, New York.
- Lewin, B. (2013) Genes XI, Jones and Bartlett Publishers, Inc.
- Robert J. Brooker (2011), Genetics: Analysis and Principles
- Microbial genetics by S.R. Maloy, J. Egronan and D. Friefelder, 2nd edition, Jones and Bartlett Publishers.
- Molecular genetics of Bacteria by Jeremy W. Dale & Simon F. Park, 5th Edition (2010) John wiley and sons
- Gilbert SF. Developmental Biology. 10th edition. Sunderland (MA): Sinauer Associates.
- Alberts B, Johnson A, Lewis J, et al. Molecular Biology of the Cell. 6th edition (2014). New York: Garland Science.