

**GUJARAT UNIVERSITY**  
**Syllabus for First Year B.Sc. BIOTECHNOLOGY**  
**SEMESTER I & II**  
**EFFECTIVE FROM JUNE 2023**

- ❖ First year of B. Sc. Biotechnology programme offers two theory papers of core course BT-101 and BT-103; each paper of 100 marks and practical papers BT-102 and BT-104 of 100 marks each as prescribed here under.
- ❖ Each theory paper at the external examination shall be of 3 hours duration and carry 70 marks. Each practical examination shall be of four hours duration. Total marks for practical shall be 70 each.
- ❖ Internal assessment will be of 30 marks for each theory paper and 15 marks for practical papers.
- ❖ For each theory papers there will be four lectures of 55 minutes per week. For practical there will be four lectures (two hours per practical) per week.
- ❖ Each theory paper is divided into 2 sections. Section I carrying questions from all four units giving equal weightage to each unit, while setting question paper. Question or its sub question including the options will be set from the same unit. Section II will be of short question type covering contents of all four units.
- ❖ Practical batch for external exam shall consist of 25 to maximum 30 students.

## **PROGRAMME OUTCOMES (POs)**

- **PO1** Understand the concepts of Biotechnology and demonstrate interdisciplinary skills acquired.
- **PO2** Demonstrate the laboratory skills in Cell Biology, Biochemistry, Microbiology, and Environmental Biotechnology with an emphasis on technological aspects.
- **PO3** Acquire knowledge and apply good laboratory and good manufacturing practices in Biotech industries.
- **PO4** Demonstrate communication skills, scientific writing, and data collection and interpretation abilities through Biotechnology experiments in laboratory.
- **PO5** Instilling knowledge and awareness on professional ethics, bioethical and health issues, intellectual property rights and life-long learning through career-oriented courses such as IPR, biosafety and bioethics.

## **PROGRAMME SPECIFIC OUTCOME (PSOs)**

At the end of the B.Sc. program in Biotechnology, the students will be able to:

- **PSO1** Show academic competence by understanding the basic concepts of major areas of Biotechnology and diverse phenomena observed in nature and in daily life.
- **PSO2** Gain thorough knowledge and develop interdisciplinary skills by detailed study on applications of Biotechnology in various fields for the benefit of society.
- **PSO3** Exhibit Personal and professional competence by applying appropriate tools and techniques in biotechnology, to design and perform experiments proficiently by end of the programme and become competent to pursue higher studies or join the industry sector after completion of B.Sc.
- **PSO4** Develop Research competence by acquiring ability to identify, formulate, analyze and solve scientific problems during practical sessions and learn to carry out experiments in areas of biotechnology such as Plant tissue culture biotechnology, Animal biotechnology, Enzyme Technology and Bioinformatics.
- **PSO5** Develop Entrepreneurial attitude by viewing biotechnology as a tool to develop mind and critical attitude and logical reasoning that is prepared to serve in diverse fields.

## **SEMESTER I**

### **BT 101: Introduction to Biotechnology and Molecules of Life**

**COURSE CODE: BT 101**

**NO. OF CREDITS: 03**

**LEARNING HOURS: 05 PER WEEK**

#### **COURSE OUTCOMES (COS)**

By the end of the course student should be able to:

- **C01** Understand the potential for vertical career growth in biotech-oriented industries, service sectors and related avenues and study of basis of life
- **C02** Be cognizant about structure, functions, and significance of amino acids and proteins
- **C03** Interpret the diversified structure and functions of Carbohydrates
- **C04** Differentiate the different classes and forms of lipids

#### **Unit 1: Introduction to Biotechnology and Basis of Life**

**Teaching Hours: 10**

- Historical development, major areas/divisions of biotechnology, application and scope of Biotechnology
- Nucleic Acids: Nucleoside and Nucleotides, Nitrogen bases (purines and pyrimidines),
- Structure and Function of Nucleic Acid
- Types of Nucleic Acid (A-DNA, B-DNA, Z- DNA)
- Structure and Function of RNA (mRNA, rRNA, tRNA)

#### **Unit 2: Amino Acids and Proteins**

**Teaching Hours: 10**

- Properties of amino acids (Stereoisomerism, zwitterion)
- Biological importance of amino acids
- Classification of amino acids based on "R" group
- Structure and organization of Proteins- Primary, Secondary (alpha helix-egg albumin, beta sheet-keratin, triple helix-collagen, Tertiary (myoglobin) and Quaternary (hemoglobin)
- Biological functions of proteins

**Unit 3: Carbohydrates****Teaching Hours: 10**

- Physical properties of Carbohydrates (Optical rotation),
- Chemical Properties of Carbohydrates (reducing and nonreducing, aldose and ketose)
- Classification, Structures and Functions of Monosaccharides (glucose, fructose, galactose, ribose, deoxy ribose)
- Classification, Structures and Functions of Disaccharides (lactose, sucrose, maltose)
- Classification, Structures and Functions of Polysaccharides (starch, glycogen, cellulose)

**Unit 4: Lipids****Teaching Hours: 10**

- Properties of lipids and biological function of Lipids
- Classification of lipids (Simple, derived and complex)
- Saturated and Unsaturated Fatty Acids (MUFA, PUFA)
- Structures and Functions of - Triacylglycerols, Phospholipids, Glycolipids, Lipoproteins, Steroids (Cholesterol)

**REFERENCE**

No.	Name	Author
1.	Biochemistry	Berg JM, and Tymoczko TJ Stryer L
2.	A textbook of Biochemistry	Rama Rao AV
3.	Biochemistry	Donald Voet and Voet J
4.	Lehninger's Principles of Biochemistry	Nelson DL and Cox MM
5.	Fundamentals of Biochemistry	Deb AC
6.	"Biochemistry", Fifth edition, W.H. Freeman and Company, New York, 2002	Jeremy M. Berg, John L. Tymozko and LubertStryer
7.	"Harper's Illustrated Biochemistry". McGraw Hill Education (Asia), 2006	Robert K. Murray, Daryl K. Granner and Victor W. Rodwell

## **BT-102: PRACTICALS**

**COURSE CODE: BT 102**

**NO. OF CREDITS: 02**

1. Introduction to Biotechnology Lab and basic equipments used in it.
2. General practice and maintenance of a Biotechnology laboratory.
3. Basic calculations- Normality, Molarity, Molality percent solutions (v/v, w/v).
4. Calibration of pH meter.
5. Preparation of standard solutions: Normal, Molar and Percent (w/v and v/v) solutions.
6. Introduction to Qualitative analysis of Carbohydrates.
7. Qualitative test of Monosaccharide –Glucose.
8. Qualitative test of Monosaccharide –Fructose.
9. Qualitative test of Disaccharide –Maltose.
10. Qualitative test of Disaccharide –Lactose.
11. Qualitative test of Disaccharide –Sucrose.
12. Precipitation and denaturation test of Proteins.

**SEMESTER II**  
**BT 103: Cell Biology**

**COURSE CODE: BT 103**  
**NO. OF CREDITS: 03**  
**LEARNING HOURS: 03 PER WEEK**

**COURSE OUTCOMES (COS)**

The students should be able to know:

- **C01** Cell as a structural and functional unit of life, cellular composition, and different life forms viz. prokaryotes, eukaryotes, and archaea.
- **C02** Comparing the cellular morphologies and, structure and functions of cell wall and cell membrane.
- **C03** The structure and chemistry of cell and its sub-cellular components.
- **C04** Cellular processes linked to its growth, division, metabolism, and expression of traits.

**Unit 1: Introduction to Cell biology**

**Teaching Hours: 10**

- History of Cell biology, Cell as basic unit of life, Cell theory, Protoplasm theory
- Broad classification of cell types: Bacteria, Archaea (prokaryotic) and eukaryotic cells and their similarities and differences.

**Unit 2: Cell wall and Cell membrane**

**Teaching Hours: 10**

- Structure and functions of cell wall: Bacterial cell wall, Plant cell wall and Fungal cell wall.
- Structure and functions of plasma membrane: Fluid mosaic model, exocytosis, endocytosis, phagocytosis – vesicles and their importance in transport.
- Cytoskeleton structure – microtubules, microfilaments, intermediate filament.

**Unit 3: Cell organelles**

**Teaching Hours: 10**

- Structure, composition, and functions of cell organelles:  
Nucleus, Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi apparatus, Lysosomes, Peroxisomes, Ribosomes

**Unit 4: Cell division****Teaching Hours: 10**

- Phases of Mitosis and Meiosis & its Significance
- Cell cycle phases, checkpoints and regulation
- Tumor: types, molecular basis, and developmental stages
- Types of Cell death: Apoptosis and Necrosis
- Cell senescence: Theories and significance

**REFERENCE**

No.	Name	Author
1.	Becker's World of the Cell. 9 <sup>th</sup> Edn (Global Edition). Pearson Education Ltd.	Hardin J. and Bertoni G. (2017)
2.	Karp's Cell and Molecular Biology – Concepts and Experiments. 8th Edn. John Wiley and Sons	Karp G., Iwasa J. and Masall W. (2015)
3.	The Cell – A Molecular Approach, 8 <sup>th</sup> Edn., Sinauer Associates Inc., Oxford University Press	Cooper G.M. (2019)
4.	Campbell Biology in Focus. Pearson Education	Urry L.A. Cain M.L., Wasserman S.A., Minorsky P.V., Jackson R.B. and Reece J.B. (2014)
5.	Essential Cell Biology. W.W. Norton & Company	Albert B., Hopkin K., Johnson A.D., Morgan D., Raff M., Roberts K. and Walter P. (2018)
6.	Raven and Johnson's Biology. 9th Edn. Mc Graw Hill publications	Mason K.A., Losos J.B. and Singer S.R. (2011)
7.	Molecular biology of cell, 6th edn., Garland Science, Taylor and Francis	Alberts B., Johnson B., Lewis J., Morgan D., Raff M., Roberts K. and Walter P. (2015)
8.	The Cell: A visual tour of the building block of life, The University of Chicago Press and Ivy Press Ltd.	Challoner J. (2015)
9.	Cell and Molecular Biology, 4th edition, Rastogi Publications	Gupta, P. K. (2015)
10.	Cell and Molecular Biology. John Wiley and Sons	Sheeler P., Bianchi D.E.
11.	Cell and Molecular Biology	De Roberties

## **BT 104: PRACTICALS**

**COURSE CODE: BT 104**

**NO. OF CREDITS: 02**

- 1) Demonstration of advance laboratory instruments (UV-Vis Spectrophotometer, Centrifuge, Electrophoretic apparatus, and PCR).
- 2) Sterilization techniques and aseptic handling of microbial cultures.
- 3) Monochrome staining of yeast.
- 4) Study of bacteria using differential staining method (Gram staining).
- 5) Differential staining of Nucleus from human WBCs.
- 6) Study of different phases of Mitosis using Onion root tip.
- 7) Observation of cell motility using hanging drop method.
- 8) Microscopic observation of wet mount preparation from Fungi.
- 9) Estimation of total sugar using Cole's method.
- 10) Estimation of protein using Biuret method.



# Gujarat University

## Proposed syllabus for Skill Enhancement Courses (SEC)

### First Year B.Sc. (Basic/Hons)

### Semester-I

Effective from June-2023

## SEC- Fundamentals of Computers in Biotechnology

### Course Structure with credits, hours, and marks

Course Type	Course	Credit	Work hours/week	Exam hours	Marks		Total Marks
					Internal	External	
Skill Enhancement Course	SEC	3	3	3	30	70	100

### Course Objectives:

1. Introduction of computers to biology students.
2. Create spreadsheets, charts and presentations.
3. Understanding basic tools used in handling of data
4. Acquire knowledge on primary biological database storage and retrieval

### Course Outcomes:

On the completion of the course students will be able to:

1. Know the fundamental terms associated with computers and basics of primary Biological databases.
2. Know different types of MS office applications and their use in Biology.
3. Understand the basic uses and applications of computer in handling Biological data.

### Assessment Methods:

- Class participation and engagement
- Quizzes and exams
- Written assignments, such as research papers or case studies
- Group projects or presentations
- Final exam or project

## **Unit 1: Fundamentals of Computers/Basics of Computers**

- **Introduction to Computers:** Definition of Hardware and software
- **Computer Hardware:** Input devices, Output devices, Central Processing Unit (CPU), Storage devices
- **Computer software:** System software (Operating systems: Windows and Linux), basics of Application Software
- **Biological data:** Primary Biological database storage and retrieval (e.g. NCBI)

## **UNIT 2: Word Processing Software and its use in Biotechnology**

- **Home:** Using the settings for font color, font size, font style, alignment, bullets, format painter and line spacing.
- **Insert:** Addition of tables, shapes, photos, charts, graphs, headers, footers, page numbers, equation, symbols, and links.
- **Design:** Selection of the template or design used to build the document. Selecting the proper tab for increasing the visual appeal of the article.
- **Applications in Biotechnology:** Review of Literature and preparation of research report of any disease.

## **Unit 3: Spread Sheet and biological data management**

- **Elements of Electronic Spread Sheet-** Opening of Spread Sheet, Addressing of Cells.  
Printing of Spread Sheet, Saving Workbooks
- **Manipulation of Cells-**Entering Text, Numbers and Dates, Creating Text, Number and Date Series, Editing Worksheet Data, Inserting and Deleting Rows and Column,
- **Formulas and Function-** Using basic Formulas (Autofill, AutoSum functions and absolute reference)
- **Charts and Tables of biological data-** Tables, Column Chart, Line Chart, Pie Chart (Create data sheet containing 50 patients visiting hospital (blood pressure, heart beat, weight, height, haemoglobin levels, sex, age and disease). Draw relevant chart and analyse the data).

## **Unit 4: Introduction to Scientific Presentation**

- **Setting up Presentation:** New, Open, Close, Save, Save As, Typing the text, Alignment of text, Formatting Text (Font Size, Font Style, Font Color, Use the Bold, Italic, and Underline), Cut, Copy, Paste, Select All, Find & Replace
- **Creating slides and applying themes:** Inserting new slide, Changing layout of slides, Duplicating slides, Copying and pasting slide, Applying themes to the slide layout, Changing theme colour, Formatting slide background
- **Working with bullets and numbering:** Multilevel numbering and Bulleting, Page bordering, Page background, Aligning text, Text directions, Columns option
- **Working with Objects:** Inserting slide header and footer, Inserting Text boxes, Inserting shapes, Inserting Word art, Inserting symbols and Slide show option
- Create a powerpoint presentation about Covid 19 disease (introduction, history, causes, symptoms, pathogenesis, vaccines).

## Proposed Practicals

1. Introduction to Windows and Linux, computer properties, how to find version and Other basic computer information.
2. Basic Operations of computer: Mouse (click, click and drag, double click, right click (for the context menu) and Keyboard (enter, Delete, backspace, shift, tab and arrows) Start and Shutdown
3. Use of Keyboard shortcuts for basic work in windows (Cut, copy, paste, show desktop, change or close window, shutdown)
4. Creation of Basic document file in MS word. (CV/Leave application/Practical Protocol)
5. Creation of SOP document file in MS word. (Header, Footer, table elements)
6. Basic statistical analysis using MS Excel (Sum, Average, Standard deviation etc)
7. Graphical representation of data using MS Excel. (Pie chart, Bar chart, area chart, error bars)
8. Creation of PowerPoint presentation for scientific topic and insertion of image files from desktop.
9. Creating PowerPoint presentation with Tables, Pie chart.
10. Retrieving data from biological databases

## **REFERENCE**

No.	Name	Author
1.	World wide web Design with HTML(First Edition-2010)	Tata McGraw Hill By C Xavier
2.	Web Enabled commercial application development using HTML, Javascript, DHTML and php	Ivan Bayross
3.	The Complete Reference HTML and CSS (Fifth Edition)	Thomas A Powell

## **WEB SOURCES**

1. <http://www.tutorialspoint.com/ht...>
2. <https://www.udemy.com/learn-html...>
3. HTML 5 Cheat Sheet (PDF) - Smashing Magazine
4. <http://html5please.com/>
5. <http://diveintohtml5.info>