

Gujarat University
Syllabus BSc Biotechnology Sem I and II (Proposed wef June 2019)

Program Outcomes:

Bachelor of Science in Biotechnology shall be three year program covering theory and practical courses and project. The program outcomes are to make student understand basic biology, its technological applications in the line of betterment of humankind. The program objectives are:

1. Provide advanced education in biotechnology to produce competent science personnel.
2. Promote interaction among broad disciplines of knowledge including, but not limited to chemistry, physics, medical, engineering, mathematics, computer science and technology.
3. Develop skilled human resource and intellectuals to contribute to national growth.
4. Create work-force to administer and operate within industries, laboratories and academia for better life in the present era through innovation in biotechnology and entrepreneurship.
5. Programs aimed at attaining these objectives by imparting necessary concepts, expertise, skill, and confidence at the cutting edge level to meet aspirations of the society.

Admission:

1. Students passing Std. XII or equivalent exam with any biological science subject shall be eligible for admission to the program as per university norms.
2. Sharp observation, analytical mind, problem solving aptitude, computational skill and scientific temperament shall be advantageous for this program.
3. General interest in the biology and / or engineering and dedication to creative thing for its applications shall be desirable qualities.
4. A flair for laboratory work, neatness and accuracy would promote success.
5. Methodological and patient by nature and able to work independently can be useful
6. Student must have good command over English and regional language shall be desirable.

Supportive Courses:

1. The overall content of the core curriculum shall offer a comprehensive content to covers up interdisciplinary area of physics, chemistry, biology, engineering, computer science, statistics, mathematics, management, economics, and law as relevant to biotechnology.
2. The program shall be offered along with following subjects of Chemistry and / or Microbiology for two years and optionally Zoology or Botany for one year. These subjects shall help building strong foundation for these subjects and its relevance to biotechnology.
3. Along with core courses, Elective and Foundation shall be as per university norms.
4. Short project of equal credit can be optionally taken *in lieu* of subject elective papers in third year.

Institutional Resource:

1. The center offering B.Sc. Biotechnology program must establish following resources earmarked.
2. Dedicated laboratory for students as per university norms
3. Space for allied facilities like storage, preparation, sterilization, and disposal.
4. Glassware, Chemicals, Reagents and Apparatuses essential for laboratory sessions
5. Collection of books prescribed in the syllabus and reference books
6. Computer laboratory with atleast 10 personal computers with required software licenses
7. ICT infrastructure with Desktop / Laptop, LCD presenter and High speed internet connectivity
8. Laboratory instruments as may be required as per the practical course.
9. Teaching staff with the subject background in Biotechnology / Microbiology / Biochemistry / Biophysics / Molecular biology / Genetics / Bioinformatics / Biochemical Engineering / Pharmacy (diversity maintained)
10. Non-teaching staff including Laboratory Administrator, Laboratory Assistant (BSc Biotechnology / Microbiology / Biochemistry (on non-availability, any biological science), and Service staff includes Peons and Hamaal / Sweeper

Career Opportunities:

Career Opportunities: The multidisciplinary course would prepare for career in Academia, Research, technicians in Health, Pharma, Dairy, Agriculture sectors and in R&D laboratories. The technical skill would enable these graduates as Entrepreneur and self-employed consultant.

Semester-I

BTI-101 The Living Being (Credit 4, Hours 40)

Course Objectives:

1. The students should be able to know how life originated and evolved over the Earth.
2. The students should understand a biological domain and general diversity within it.
3. The students should be able to understand nature of life, its evolution and classification.
4. The students shall be prepared to work in biology laboratory, observe microbial life form and carry out biochemical analysis.

Life and its Origin

History of Earth, Theories of origin of life, Millers experiment, Quest for Extra-terrestrial life.
Properties of Water, Carbon and Biomolecules.

Evolution of Earliest life forms, Viruses, Prokaryotes, Eukaryotes, Endosymbiont Mitochondria and Chloroplast

Cell Theory, Cell differentiation, Levels of organization.

Law of Natural Selection.

Phylogenetic relation, Whittaker's five-kingdom classification.

Plant Kingdom

Plant Body: Organ system and Tissues, Stem, root, leaves.

Plant Adaptation to land, Plant sensory systems.

Growth: Nutritional requirements, Phytohormones, Reproductive structure, Pollination and Fertilization, Asexual reproduction.

Common types of plants: *Bryophytes*, *Vascular*, *Gymnosperms* and *Angiosperms* plants.

Outline of Kingdom *Plantae*.

Animal Kingdom

General characters of animal, Animal evolution, Body organization: Systems, Organs, Tissues, Coordination, Energy requirements.

Primitive and advanced marine animals, Adaptation to land, Exchange with Environment,

Outline of Kingdom *Animalia*.

The Microbial World

Bacteria: General character, Diversity, Harmful and Beneficial activities.

Eukaryotes: General character, Broad Classification and importance of Fungi, Algae and Protozoa.

Viruses: Structure, Chemical composition, Replication cycle.

General characters of Prion, Viroid and Virusoid.

References:

1. Elden D Enger, FC Ross and DB Bailey (2011) Concepts in Biology, (14th Ed), TMH
2. Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece (2017) Campbell Biology (11th Ed), Pearson
3. Mary A Clark, Matthew Douglas, and Jung Choi (2018) Biology (2nd Ed) OpenStax Rice Univ, USA
4. Cowan K and KP Talaro (2009) Microbiology: A Systems Approach, (2nd Ed), McGraw-Hill
5. Purves William K, David Sadava, Gordon H. Orians, and H. Craig Heller (2006) Life: The Science of Biology, (7th Ed), Academic Internet

BTI-102 Practical (Credits 3, Hours 40)

Laboratory course in BTI-101 The Living Being

1. Study of Laboratory Equipment
2. Preparation of Standard Solution, Stains and Buffers
3. Observation of microbes using Hanging-drop preparation
4. Microscopic observation of wet-mount preparation from fungi
5. Monochrome Staining of Yeasts
6. Colorimetric estimation of Protein using Folin's Method
7. Estimation of reducing sugar by Cole's method
8. Demonstration of aerobic respiration detecting Catalase

Semester-II

BTI-103 Cell: Structure and Function (Credit 4, Hours 40)

Course Objectives:

1. The students should be able to know cell as a structural and functional unit of life.
2. The students should understand a structure and chemistry of cell with its components.
3. The students should be able to understand cellular processes linked to its growth, metabolism and expression of traits.
4. The students shall be prepared to handle microbes, observe cellular components and activities, and understand biomolecules.

Structure of Cell

Chemistry, Ultrastructure and Functions of: Cell wall, Membrane, Flagella and Cilia, Organelles Mitochondria, Chloroplast, Golgi bodies, Peroxisome, Endoplasmic reticulum, Ribosome.

Nature of Cytosol, Cytoskeleton structures.

Cellular diversity at structural and compositional levels among Prokaryotes, Archeobacteria, and Eukaryotes (Plant, Animal and Fungi).

Cellular Metabolism

Oxidation-Reduction, Energy and Carbons source utilization, Modes of ATP generation, Generation of Reducing power, Electron Transport Chain and ATP generation.

Metabolism: Anabolism, Catabolism, Respiration, Fermentation, Photosynthesis.

Nutrient uptake Active transport, Passive transport, Facilitated diffusion, Group translocation.

Enzymes: Properties, Mechanism of catalysis, Activation energy, Factors affecting enzyme action.

Cell Division

Cell division, Phases of Mitosis and Meiosis, Significance.

Cell cycle: Phases, Check-points, Regulators.

Growth: Generation time and Growth rate.

Tumor: Types, Developmental stages, Carcinogens, Oncogenes.

Apoptosis: Events, Types, Autophagy.

Senescence: Theories and Significance.

Cell Expression

Central dogma of Life, Concept of Gene, Transcription, Translation and expression.

Coordination of Metabolism at Enzyme Activity (Allosteric control) and Synthesis (Feed-back regulation and Operon Model) levels.

Cell communication: Signal molecules, Receptors, Junction, Plasmodesmata and Cell signaling process.

References:

1. Elden D Enger, FC Ross and DB Bailey (2011) Concepts in Biology, (14th Edn), TMH
2. Purves William K, David Sadava, Gordon H. Orians, and H. Craig Heller (2006) Life: The Science of Biology, (7th Ed), Academic Internet
3. Lodish Harve et al (2008) Molecular Cell Biology, (6th Ed), Freeman
4. Cassimeris Lynne, VR Lingappa and G Plopper (2011) Lewin's Cells (2nd Ed), Jones and Bartlett
5. 2. Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece (2017) Campbell Biology (11th Ed), Pearson
6. Mary A Clark, Matthew Douglas, and Jung Choi (2018) Biology (2nd Ed) OpenStax Rice Univ, USA

BTI-104 Practical (Credit 3, Hours 40)

Laboratory course in BTI-103 Cell: Structure and Function

1. Aseptic handling and transfer of microorganisms
2. Observation of bacterial cell wall by Chances staining
3. Staining of Nucleus from human WBCs / *Chiromonas*
4. Microscopic observation of Mitosis (Onion) and Meiosis (Anther)
5. Study of Human Karyotype staining and banding patterns
6. Cell count and viability ratio by vital stain and Neubauer chamber
7. DNA estimation by colorimetric method using Diphenylamine
8. Glucose estimation by enzymatic method using Glucose oxidase