

Rayat Shikshan Sanstha's
Karmaveer Bhaurao Patil College, Vashi
(AUTONOMOUS)



Syllabus for Approval

Sr. No.	Heading	Particulars
1.	Title of the Course	F.Y.B.Sc. in Biotechnology
2.	Eligibility for Admission	H.S.C.
3.	Passing Marks	40%
4.	Ordinances/ Regulation	
5.	No. of Years/ Semester	1 Year / 2 Semesters
6.	Level	Undergraduate (UG)
7.	Pattern	Semester
8.	Status	Revised (Under Autonomous Status)
9.	To be implemented from Academic Year	2021-22

Date:

Name of BOS Chairperson: _____ Signature: _____

**RAYAT SHIKSHAN SANSTHA'S
KARMAVEER BHURAO PATIL COLLEGE, VASHI
(AUTONOMOUS)**



Proposed Syllabus

For

F.Y. B.Sc. in Biotechnology

2021-22

Preamble of the Syllabus:

Bachelor of Science (B.Sc.) in Biotechnology is a under graduation course of Department of Biotechnology, Karmaveer Bhaurao Patil College Vashi, Navi Mumbai, affiliated to University of Mumbai (MH). Biotechnology is defined as the application of technological principles for the processing or manipulating biological agents to provide goods and services. It derives its strength by harnessing biological processes that sustain life. It is a technology that is more reliable and firm. Biotechnology has the potential to transform the lives of the people by impacting hugely on agriculture, animal husbandry, health and medicines, environment, sustainable development, etc. Biotechnology has accomplished tremendous applications in just a matter of time. People have just started to recognize the endless window of opportunities it has open. Biotechnology has revolutionized the recent advancements in research and development. CBSGS: The Choice Based Semester and Grading System to be implemented through this curriculum, would allow students to develop a strong footing in the fundamentals and specialize in the disciplines of his/her liking and abilities.

Program Education Objective (PEO's):

To prepare students to prime for-

- Higher education and research in field of biotechnology and related subjects.
- Careers related broadly to biotechnology and life sciences. Students will embark upon diverse career paths medical coding/pharmaceutical/biotechnology industries, and use their education in a variety of related endeavors.

Course Objective:

- To produce students who understand fundamental principles of basic sciences and apply that understanding to analyze, solve problems and interrelate with current technological developments.
- To promote independent learning and add rationale thinking, knowledge ability by activity based learning, innovative, teaching learning and evaluation methods.

Name of the Faculty: Science and Technology

Name of the Program: BSc

Program Outcomes (POs):

PO-1	Disciplinary Knowledge: Understand the basic concepts, fundamental principles, theoretical formulations and experimental findings and the scientific theories related to Physics, Chemistry, Mathematics, Microbiology, Computer Science, Biotechnology, Information Technology and its other fields related to the program.
PO-2	Communication Skills: Develop various communication skills such as reading, listening and speaking skills to express ideas and views clearly and effectively.
PO-3	Critical Thinking: Propose novel ideas in explaining the scientific data, facts and figures related to science and technology.
PO-4	Analytical Reasoning and Problem Solving: Hypothesize, analyze, formulate and interpret the data systematically and solve theoretical and numerical problems in the diverse areas of science and technology.
PO-5	Sense of Inquiry: Curiously ask relevant questions for better understanding of fundamental concepts and principles, scientific theories and applications related to the study.
PO-6	Use of Modern Tools: Operate modern tools, equipments, instruments and laboratory techniques to perform the experiments and write the programs in different languages (software).
PO-7	Research Skills: Understand to design, collect, analyze, interpret and evaluate information/data that is relevant to science and technology.
PO-8	Application of Knowledge: Develop scientific outlook and apply the knowledge with respect to subject.
PO-9	Ethical Awareness: Imbibe ethical, moral and social values and exercise it in day to day life.
PO-10	Teamwork: Work collectively and participate to take initiative for various field-based situations related to science, technology and society at large.
PO-11	Environment and Sustainability: Create social awareness about environment and develop sustainability for betterment of future.
PO-12	Lifelong Learning: Ability of self-driven to explore, learn and gain knowledge and new skills to improve the quality of life and sense of self-worth by paying attention to the ideas and goals throughout the life.

Name of the Faculty: Science and Technology

Name of the Program: BSc Biotechnology

Program Specific Outcomes (PSOs):

Students will be able to –

PSO-1	Identify, understand and analyze problems and propose valid solutions related to field of Biotechnology.
PSO-2	Critically evaluate biotechnological solutions on environment and societies keeping in mind the need for sustainable solutions.
PSO-3	Develop a research based ideology and technical skills to build career in Biotechnology.

Scheme of examination for Each Semester:

Continuous Internal Evaluation: 40 Marks (Common Test-20 Marks & 20 Marks for Assignment, Projects, Group discussion, Open book test, online test etc.)

Semester End Examination: 60 Marks will be as follows –

I	Theory:	
	Each theory paper shall be of two and half hour duration.	
	All questions are compulsory and will have internal options	
	Q-1	From Unit – I (having internal options.) 12 M
	Q-2	From Unit – II (having internal options.) 12 M
	Q-3	From Unit – III (having internal options.) 12 M
	Q-4	From Unit – IV (having internal options.) 12 M
	Q-5	Questions from all the FOUR Units with equal weightage of marks allotted to each Unit. 12 M
II	Practical:	The External examination per practical course will be conducted as per the following scheme.
Sr. No.	Particulars of Semester End Practical Examination	Total Marks
I	Semester end Practical Exam	300

SEMESTER-I

F.Y. B. Sc Biotechnology (Honours)
Proposed Semester I Syllabus
2021-22

Semester I

Course code	Course Title	Credits	Course code	Course Title	Credits	Credits Total
Core Courses						
UGBTC101	Basic concepts of Biology	4	UGBTC P-101	Basic concepts of Biology Practical	2	6
UGBTC102	Basics of Microbiology	4	UGBTC P-102	Basics of Microbiology Practical	2	6
Ability Enhancement Courses						
UGBTAEC101	Environmental Sciences-I	4				4
ACC-1	Audit Credit Course -1	2				2
Generic Elective Courses (Any 1)						
UGBTGE101	Fundamentals of Chemistry	4	UGBTGE P-101	Fundamentals of Chemistry Practical	2	6
UGBTGE102	Biostatistics	4	UGBTGE P-102	Biostatistics Practical	2	6

Core Courses

Title of Paper: UGBTC101 Basic concepts of Biology

Course Outcome	<p>Students will be able to –</p> <ul style="list-style-type: none"> • Identify different plants & animals on the basis of their classification • Recognize basic common structures of plants & animals • Compare between vertebrates and invertebrates and classify vertebrates into various groups • Describe common groups of bacteria and archaea in different ecosystems, and their role • Explain the ultra structure of prokaryotic and eukaryotic cells and know the function of various cell organelles present
Unit 1 Classification of Plants	<p>Characteristics, habitat etc. of Algae, Bryophyta, Pteridophyta, Gymnosperms and Angiosperms (with one example each)</p>
Unit 2 Classification of Animals	<p>Characteristics of Non-Chordates and Chordates Salient features of Non-Chordates upto phylum level- Porifera, Cnidaria, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata, Hemichordata (with at least one representative example). Salient features of Phylum Chordata and its classes-Pisces, Amphibia, Reptilia, Aves and mammalia (with at least one representative examples)</p>
Unit 3 Microbial Biodiversity: Prokaryotes	<p>General Structure, Characteristics, Examples and Applications of Archaeobacteria, Eubacteria, Blue-green Algae, Actinomycetes, Eumycota Concept of prokaryotic cell Shape and Size, Detail structure of Slime Layer, Capsule, Flagella, Pilli, Cell Wall (Gram Positive and Negative), Cell Membrane, Cytoplasm and Genetic Material Storage Bodies and Spores, Plant, animal & bacterial virus with example, Structure, and significance of virus</p>
Unit-4 Microbial Biodiversity: Eukaryotes	<p>Ultra structure of Eukaryotic Cell: Plasma membrane, Cytoplasmic Matrix, Microfilaments, Intermediate Filaments, and Microtubules Organelles of the Biosynthetic-Secretory and Endocytic Pathways –Endoplasmic Reticulum & Golgi Apparatus. Lysosome, Endocytosis, Phagocytosis, Autophagy, Proteasome Eucaryotic Ribosomes, Mitochondria and Chloroplasts, Nucleus – Nuclear Structure, Nucleolus External Cell Coverings: Cilia And Flagella, Comparison Of Prokaryotic And Eukaryotic cell</p>

UGBTC 101 Basic concepts of Biology-References

1. An introduction to Biodiversity by Pritipal Singh, Ane's Students Edition.
2. Invertebrate Zoology by Jordan and Verma, Revised edition.
3. Microbiology by Pelczar, Chan and Krieg, 5th edition.
4. Microbiology by Prescott and Harley.
5. The Cell by Cooper and Hausman, 4th edition
6. Microbiology An Introduction, Tortora, 8th edition

Title of Paper: UGBTC102 Basics of Microbiology

<p>Course Outcome</p>	<p>Students will be able to –</p> <ul style="list-style-type: none"> • Understand scientific vocabulary relevant to microbiology • Enlist the major discoveries that gave rise to the field of microbiology and Biotechnology • Explain the importance of sterilization, disinfection and biosafety • Evaluate and assess the different types of bacteria on the basis of staining and microscopy techniques • Employ cultivation techniques to grow and enumerate microorganisms
<p>Unit 1 Introduction to microbiology</p>	<p>Introduction, discovery of microorganisms (Spontaneous generation theory, germ theory), history of microbiology (Contributions of Leeuwenhoek, Robert Koch, Joseph Lister, Louis Pasteur, Edward Jenner, Alexander Fleming, Paul Ehrlich) Basics of Microscopy: Concepts, Bright field, Dark field and Phase contrast microscopy, Fluorescence microscopes and overview of Electron microscopes.</p>
<p>Unit 2 Stains and staining methods</p>	<p>Stains and staining solutions - Definition of dye and chromogen. Structure of dye chromophore and fluorescent dyes. Functions of mordant and fixative. Natural and synthetic dyes. Simple staining (monochrome), Differential staining (Gram's staining) and acid fast staining, polychrome staining (Romanowsky's staining)</p>
<p>Unit 3 Sterilization, Disinfection, handling of microorganisms and Biosafety</p>	<p>Definition: Sterilization and Disinfection. Types and Applications Dry Heat, Steam under pressure, Gases, Radiation and Filtration Chemical Agents and their Mode of Action - Aldehydes, Halogens, Quaternary Ammonium Compounds, Phenol and Phenolic Compounds, Heavy Metals, Alcohol, Dyes, and Detergents Ideal Disinfectant. Examples of Disinfectants and Evaluation of Disinfectant</p>
<p>Unit 4 Nutrition, Cultivation and enumeration of microorganisms</p>	<p>Nutritional Requirements : Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulphur and Growth Factors. Classification of Different Nutritional Types of Organisms. Design and Types of Culture Media- Complex, Synthetic, Differential, Selective Enrichment, Enriched media Concept of Isolation and Methods of Isolation. Pure Culture Techniques Growth and Enumeration Growth phases, Growth Curve. Arithmetic Growth and Growth Yield. Measurement of Growth. Chemostat and Turbidostat Enumeration of Microorganisms- Direct and Indirect Methods Preservation of Cultures- Principle and Methods. Cryogenic Preservation, Advantages and Limitations</p>

UGBTC102 Basics of Microbiology-References

1. Fundamental Principles of Bacteriology, A. J. Salle, 7th Edition.
2. Fundamentals of Microbiology, Frobisher, 9th Edition
3. Microbiology by Pelczar, Chan & Krieg, 5th Edition
4. Microbiology by Prescott, Harley and Klein, 5th Edition
5. Industrial Microbiology, A. H. Patel, 2nd Edition

Ability Enhancement Courses

Title of Paper: UGBTAEC101: Environmental Sciences-I

<p>Course Outcome</p>	<p>Student will be able to –</p> <ul style="list-style-type: none"> • Understand the importance of environmental studies • Distinguish different types of Natural Resources and its importance • Analyze different types of ecosystem on the basis of its structure and characteristics. • Categorize Biogeographical classification of India and the Value of biodiversity • Enlist different types of pollution, causes behind it and its impact on environment
<p>Unit -1 Multidisciplinary nature of environmental studies & Natural Resources</p>	<p>Definition, scope and importance, Need for public awareness. Renewable and non-renewable resources: Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles.</p>
<p>Unit-2 Ecosystems</p>	<p>Concept of an ecosystem. IV • Structure and function of an ecosystem. • Producers, consumers and decomposers. • Energy flow in the ecosystem. • Ecological succession. • Food chains, food webs and ecological pyramids. • Introduction, types, characteristic features, structure and function of the following ecosystem :- a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)</p>
<p>Unit 3 Biodiversity and its conservation</p>	<p>Introduction – Definition : genetic, species and ecosystem diversity. • Biogeographical classification of India • Value of biodiversity : consumptive use, productive use, social, ethical,</p>

	aesthetic and option values • Biodiversity at global, National and local levels. • India as a mega-diversity nation V • Hot-spots of biodiversity. • Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts. • Endangered and endemic species of India • Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.
Unit-4 Environmental Pollution	Definition • Cause, effects and control measures of :- a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards • Solid waste Management : Causes, effects and control measures of urban and industrial wastes. • Role of an individual in prevention of pollution. • Pollution case studies. • Disaster management: floods, earthquake, cyclone and landslides.

UGBTAEC101: Environmental Sciences- References

1. Textbook of Environmental Sciences, Erach Bharucha
2. Environmental Chemistry, B. K. Sharma, 12th Edition
3. Environmental Science, S. C. Santra

Audit Credit Course-1 (Self Development Program)

Course Outcome	Student will be able to- <ul style="list-style-type: none"> • imbibe ethical, moral and social values and exercise it in day to day life. • connect to their inner self and understand their core values. • Make appropriate choices on the basis of the particular situation. • Lead balanced life with proper time and stress management. • Understand others with empathy.
Orientation: (StartUp)	
Module-1	Connection
Module-2	Core
Module-3	Context
Module-4	Choices
Module-5	Causality
Module-6	Community

Discover -1	
Module-1	Heartfulness Enabled Leadership Mastery - An Overview
Module-2	Discovering the Personality
Module-3	Healthy Lifestyle
Module-4	Time Management-I
Module-5	Time Management-II
Module-6	Befriending Stress
Module-7	Peak Performance
Module-8	Situational Awareness
Module-9	Heartful Conversations
Module-10	Heartful Relationships

Generic Elective Courses

Title of Paper: UGBTGE101 Fundamentals of Chemistry

Course Outcome	Student will be able – <ul style="list-style-type: none"> • To understand the basic concepts of chemistry like nomenclature and classification of compounds, • To understand chemical bonds and examples of various types of bonds present in biological components • To impart hands-on skills in preparation of Buffers and Solutions • To acquaint with types of Isomerism, conformation and configuration
Unit 1 Nomenclature and Classification of Organic compounds and Inorganic compounds	Nomenclature and Classification of Organic compounds Alkanes, Alkenes, Alkynes, Cyclic hydrocarbons, Aromatic compounds, Alcohols and Ethers, Aldehydes and Ketones, Carboxylic acids and its derivatives, Amines, Amides, Alkyl halides and Heterocyclic compounds Nomenclature and Classification of Inorganic compounds Oxides, Salts, Acids, Bases, Ionic, Molecular and Coordination Compounds
Unit 2 Chemical bonds and Chemistry of water	Properties of Water, Interaction of Water with solutes (Polar, Non-polar, Charged), non-polar compounds in water – change in its structure and the hydrophobic effect, role of water in bio molecular structure and function and water as a medium for life Ionic bond: Nature of Ionic bond, structure of NaCl, KCl and CsCl, factors influencing the formation of ionic bond. Covalent Bond: Nature of covalent bond, structure of CH ₄ , NH ₃ , H ₂ O, shapes of BeCl ₂ , BF ₃ Coordinate Bond: Nature of coordinate bond, Non Covalent bonds: Van Der Waal's forces: dipole - dipole, dipole - induced dipole. Hydrogen Bond: Theory of hydrogen bonding and types of hydrogen bonding (with examples of RCOOH, ROH, salicylaldehyde, amides and polyamides).
Unit 3 Solutions-mole concept, Acids and bases, Buffers	Solutions: Normality, Molarity, Molality, Mole fraction, Mole concept, Solubility, Weight ratio, Volume ratio, Weight to volume ratio, ppb, ppm, millimoles, milliequivalents (Numericals expected). Primary and Secondary Standards: Preparation of standard solutions, Principle of Volumetric Analysis. Acids and Bases: Lowry-Bronsted and Lewis Concepts. Strong and Weak Acids and Bases - Ionic product of Water -pH, pKa, pKb. Hydrolysis of Salts. Buffer solutions – Concept of Buffers, Types of buffers, Derivation of Henderson equation for acidic and Basic buffers, Buffer action, Buffer capacity. (Numericals expected.) pH of buffer solution.

Unit 4 Stereochemistry	<p>Types of Isomerism: Constitutional Isomerism (Chain, Position and Functional) and Stereoisomerism, Chirality.</p> <p>Geometric Isomerism and Optical Isomerism: Enantiomers, Diastereomers, and Racemic mixtures Cis-Trans, Threo, Erythro and Mesoisomers. Diastereomerism (Cis-Trans Isomerism) in Alkenes and Cycloalkanes (3 and 4 membered ring)</p> <p>Conformation: Conformations of Ethane. Difference between Configuration and Conformation.</p> <p>Configuration, Asymmetric Carbon Atom, Stereogenic/ Chiral Centers, Chirality,</p>
-----------------------------------	--

UGBTGE101 Fundamentals of Chemistry-References

1. Organic Chemistry by Stanley Pine
2. Organic Chemistry, Bahl and Bahl
3. Concise Inorganic Chemistry, J.D. Lee
4. Lehninger's Principle of Biochemistry, Nelson and Cox
5. Textbook of physical chemistry, Samuel Glasstone

Title of Paper: UGBTGE102 Biostatistics

Course Outcome	Students will be able - <ul style="list-style-type: none">• To develop numerical ability to solve mathematical problems• Understand the central concepts of statistical theory and their probabilistic foundation and demonstrate statistical reasoning skills correctly• Apply basic statistical concepts commonly used in Health and Medical Sciences• Understand the differences between standard deviation and standard error• Acquire knowledge based on correlation analysis
Unit 1 Basics of Mathematics	Number system- Prime number, Whole number, Decimals, Addition, Subtraction, Multiplication, Division. Classification of numbers Number line, Cartesian system, Fractions, Set theory, Probability Numerical ability-Time & Work, Number series
Unit 2 Introduction to Biostatistics	Definition and Importance of Statistics in Biology Types of Data, Normal and Frequency Distribution Types of population sampling Measures of Central tendency (For Raw, Ungroup & group Data) Mean, Median, Mode.
Unit 3 Measures of dispersion & Correlation	Standard Derivation (SD), Standard Error (SE), Difference between SD and SE, Measures of Dispersion, Range, Variance, Coefficient of Variance, Problems based on correlation analysis
Unit 4 Data Representation	Data Representation - Dot diagram, Bar diagram, Histogram, Polygon, Pie Charts, Curve (Theory and Problems based learning)

UGBTGE102 Biostatistics-References

1. Basic concepts of Biostatistics, N. Armugam
2. General aptitude (Theory& Practice), Ajay Kumar and Anand Kumar
3. Methods in Biostatistics, B.K. Mahajan

F.Y.B.Sc.

Proposed Semester I Practicals

UGBTCP-101 Basic concepts of Biology

1.	Study of Plant, Animal and Microbial Groups with at least one examples from each (permanent slide and specimens)
2.	Study of Photomicrographs of Cell Organelles
3.	Slide culture technique and fungal staining
4.	Identification of different algal specimens
5.	Special Staining of prokaryotic cells-Capsule
6.	Special Staining of prokaryotic cells-Endospore
7.	Cell wall staining- Chances's method

UGBTCP-102 Basics Microbiology

1.	Study of various parts of compound microscope
2.	Monochrome Staining, Negative Staining, Motility Testing
3.	Differential Staining- Gram Staining, and Acid Fast Staining and Romonowsky Staining
4.	Working and application of basic lab equipment- autoclave, hot air oven, incubator
5.	Preparation of Media and Aseptic transfer- Nutrient broth and Agar, MacConkey Agar, Sabourauds Agar
6.	Isolation of Organisms : T-streak, Polygon method
7.	Enumeration of microorganisms by Serial Dilution, Pour Plate, Spread Plate Method, Breeds count

UGBTGEP-101 Fundamentals of Chemistry

1.	Safety Measures and Practices in Chemistry Laboratory, Working and use of a Digital Balance, Functioning and Standardization of pH Meter, Optical Activity of a Chemical Compounds by Polarimeter
2.	Preparation of Standard (Molar, Molal and Normal solutions) and Buffer Solutions Determination of strength of HCl in commercial sample
3.	Qualitative Analysis of Inorganic Compounds - Three experiments
4.	Characterization of Organic Compounds containing only C, H, O elements (no element test) - Compounds belonging to the following classes: Carboxylic Acid, Phenol, Aldehyde/Ketone, Ester, Alcohol, Hydrocarbon and Characterization of Organic Compounds containing C, H, O, N, S, Halogen Elements (element tests to be done) Compounds belonging to the following classes: Amine, Amide, Nitro Compounds, Thiamide, Haloalkane, Haloarene
5.	To Standardize commercial sample of NaOH using KHP (Potassium hydrogen pthalate) and sample of HCl using borax.
6.	Dissociation Constant of Weak Acids by Incomplete Titration Method using pH Meter and determination of Acetic acid in Vinegar by Titrimetric Method
7.	Determination of the amount of Fe (II) present in the given solution Titrimetrically

UGBTGEP-102 Biostatistics

1.	Mathematical problems related to probability
2.	Data Collection and Data Entry
3.	Analysis for Mean, Median, Mode and Standard Deviation
4.	Data representation using frequency Polygon, Histogram and Pie Diagram
5.	Problems related to logical mathematics

SEMESTER-II

Semester II

Course code	Course Title	Credits	Course code	Course Title	Credits	Credits Total
Core Courses						
UGBTC201	Fundamentals of Biotechnology	4	UGBTC P-201	Fundamentals of Biotechnology Practical	2	6
UGBTC202	Biochemistry-1	4	UGBTC P-202	Biochemistry-1 Practical	2	6
Ability Enhancement Course						
UGBTAEC 201	Environmental Sciences	4				4
AC-1	Audit Credit Course -2	2				2
Generic Elective Courses (Any1)						
UGBTGE20 1	Fundamentals of Computers	4	UGBTGE P-201	Fundamentals of Computers Practical	2	6
UGBTGE20 2	Fundamentals of Physics	4	UGBTGE P-202	Fundamentals of Physics Practical	2	6

Core Courses

Paper code: UGBTC201 Fundamentals of Biotechnology

Course Outcome	<p>Student will be able to –</p> <ul style="list-style-type: none"> • Understand fundamental vocabulary and Concepts of Biotechnology • Differentiate between Traditional Biotechnology and Modern Biotechnology • State various branches and applications of Biotechnology • Gain knowledge on Food Biotechnology • Understand the concept of enzyme Biotechnology, Enzyme Immobilization and various applications
Unit 1 Introduction and Scope of Biotechnology	<p>What is Biotechnology? Definition of Biotechnology, Traditional and Modern Biotechnology, Branches of Biotechnology- Pharmaceutical Biotechnology, Plant, Animal Biotechnology, Marine Biotechnology, Industrial Biotechnology, Environmental Biotechnology. Biotechnology Research in India, Biotechnology in context of developing world, Public perception of Biotechnology, Ethics in Biotechnology and IPR.</p>
Unit 2 Applications of Biotechnology	<p>In agriculture: Genetically modified plants and animals with examples, pros and cons, Application in crop and livestock improvements, Modifications in plant quality- Golden rice, Insect resistance- Bt crops, Molecular Farming, Plant based vaccines, Biopesticides, Biofertilizers In industry: Enzymes, Fermentation based products, Bio-fuel, Bio-energy In healthcare: Vaccines, Monoclonal antibodies, Stem cell research, Gene therapy In environment: GMO, Bioremediation and Biosensors</p>
Unit 3 Food Biotechnology	<p>Food Biotechnology, Biotechnological applications in enhancement of Food Quality Unit Operation in Food Processing Quality Factors in Preprocessed Food, Food Deterioration and its Control, Rheology of Food Products, Microbial role in food products; Yeast, Bacterial and other Microorganisms based process and products Modern Biotechnological Regulatory Aspects in Food Industries Biotechnology and Food - Social Appraisal</p>
Unit 4 Enzyme Biotechnology	<p>What are enzymes? Microbes producing enzymes, Properties of enzymes, Methods of enzyme production, Immobilization of enzymes, Methods of enzyme immobilization, Enzyme engineering, Applications of enzymes (Therapeutic, Analytical, Manipulative, Industrial)</p>

UGBTC201 Fundamentals of Biotechnology-References

1. Advanced Biotechnology, R.C. Dubey
2. Biotechnology, B.D. Singh
3. Biotechnology, S.N. Jogdand
4. Text book of Biotechnology, R.C. Dubey
5. Text of Biotechnology, S. Chand

Paper code: UGBTC202 Biochemistry-I

Course Outcome	Student will be able to – <ul style="list-style-type: none">• Differentiate different Biomolecules and compare their importance• Discriminate structural and functional characteristics of various Biomolecules• Illustrate the structure and Characterization of Biomolecules• Classify enzymes on the basis of enzyme kinetics and its mechanism of action• Contrast enzymes on the basis of their inhibition
Unit 1 Carbohydrates and Lipids	Carbohydrates: Introduction, Biological importance, Definition, Classification, (Glyceraldehyde, Simple Aldoses, Simple Ketoses, D-glucose, Conformation of D-glucose) Monosaccharides other than glucose, glycosidic bond, disaccharides, polysaccharides (starch, glycogen), peptidoglycan, proteoglycan matrix. Lipids: Introduction, classes, fatty acids [physical and chemical properties] simple lipids, complex lipids. Steroid lipids, structural, functional storage lipids. Saturated and unsaturated fatty acids, uses as- signal, cofactor, pigment.
Unit 2 Proteins and Amino Acids	Classification, Structure and properties of amino acids, Titration curve, Acid-Base behavior, amino acid analysis, reactions, Zwitter ions, isoelectric pH. Structure-peptide bond, -S-S (inter & intra), Primary structure, Secondary structure, Tertiary structure - Interaction (Myoglobin, Hemoglobin structure as an example), Quaternary structure - Interaction in peptide Hb Protein sequencing – Sanger’s reaction, Edman’s method, Sorenson’s titration Denaturation of proteins, coagulation of proteins Different types of Proteins in the living system
Unit 3 Nucleic acids	Nucleic Acids: Structure, Function of Nucleic Acids, Properties and Types of DNA, RNA. Structure of Purine and Pyrimidine Bases Hydrogen Bonding between Nitrogenous Bases in DNA Differences between DNA and RNA, Structure of Nucleosides, Nucleotides and Polynucleotides.
Unit 4 Enzymes	Basic concepts- Definition (zymogens, co enzymes, co factors, apoenzymes, isoenzymes) Classification, nomenclature, chemical nature, properties of enzymes, Mechanism of enzyme action, active site, enzyme specificity, Effect of pH, temperature, substrate concentration on enzyme activity. Enzyme kinetics – Micheli’s-Menten equation, types of enzyme

	inhibitions- competitive, uncompetitive, noncompetitive, Allosteric enzymes
--	---

UGBTC202 Biochemistry-1-References

1. Biochemistry, Satyanarayana, 2nd edition, Books and Allied Pvt Ltd.
2. Lehninger, Principles of Biochemistry. 5th Edition (2008), Nelson and Cox
3. Fundamentals of Biochemistry. 3rd Edition (2008), Donald Voet & Judith Voet
4. Biochemistry, 7th Edition, (2012), Jeremy Berg, Lubert Strye

Ability Enhancement Courses

UGBTAEC201: Environmental Sciences-2

Course Outcome	<p>Student will be able to –</p> <ul style="list-style-type: none"> • analyze the social issues associated with environment • enlist the different programs implemented for population, education and human rights. • Restate the role of IT in health and environment studies. • explain the concepts of liberalization, privatization and globalization. • identify environmental assets and causes of its depletion along with recommendations for its protection.
Unit 1 Social Issues and the Environment	<p>From Unsustainable to Sustainable development • Urban problems related to energy • Water conservation, rain water harvesting, watershed management • Resettlement and rehabilitation of people; its problems and concerns. Case Studies • Environmental ethics: Issues and possible solutions. • Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. • Wasteland reclamation. • Consumerism and waste products. • Environment Protection Act. • Air (Prevention and Control of Pollution) Act. • Water (Prevention and control of Pollution) Act • Wildlife Protection Act • Forest Conservation Act • Issues involved in enforcement of environmental legislation. • Public awareness.</p>
Unit 2 Human Population and the Environment	<p>Population growth, variation among nations. • Population explosion – Family Welfare Programme. VII • Environment and human health. • Human Rights. • Value Education. • HIV/AIDS. • Women and Child Welfare. • Role of Information Technology in Environment and human health. • Case Studies.</p>
Unit 3 Globalization and its Impact	<p>Understanding the concepts of liberalization, privatization and globalization; Growth of information technology and communication and its impact manifested in everyday life; Impact of globalization on industry: changes in employment and increasing migration; Changes in agrarian sector due to globalization; rise in corporate farming and increase in farmers' suicides</p>
Unit 4 Field work	<p>Visit to a local area to document environmental assets river/forest/grassland/hill/mountain • Visit to a local polluted site-Urban/Rural/Industrial/Agricultural • Study of common plants, insects, birds. • Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)</p>

UGBTAEC101: Environmental Sciences- References

1. Textbook of Environmental Sciences, Erach Bharucha
2. Environmental Chemistry, B. K. Sharma, 12th Edition
3. Environmental Science, S. C. Santra

Audit Credit Course -2 (Self Development Program)

Course Outcome	Student will be able to – <ul style="list-style-type: none">• choose correct way of living• transform themselves to their better version• practice meditation and relaxation techniques to keep them calm in all situations
Discover-2	
Module-1	Silence is the Language of the Heart
Module-2	The Science Behind Meditation: Habits and Change
Module-3	The Art Behind Meditation: Observation and Diary Writing
Module-4	The Heart Behind Meditation: Experience and Evolution
Module-5	Live Light
Module-6	Live Right
Module-7	The Power of Pause
Module-8	Designing your Destiny 1
Module-9	Designing your Destiny 2
Module-10	Practice! Experience!

Generic Elective Courses

UGBTGE201 Fundamentals of Computers

Course Outcome	<p>Student will be able to –</p> <ul style="list-style-type: none"> • Demonstrate a basic understanding of computer hardware and software • Tackle computer-based tasks more confidently • Learn to use and configure essential office applications including word processing, spreadsheets. • Develop a basic understanding of technologies and protocols used on the Internet • Analyze big data using different applications • Identify cyber crime threats and implement the knowledge of cyber security.
Unit 1 Basics of Computers and Internet	<p>Organization of a Computer; I/O Units; Computer Memory; Processor; Binary Arithmetic; Logic Circuit; Architecture; Operating System, Spreadsheets, Graphing with excel and Power point</p> <p>Internet Basics: Connecting to the Internet, E-mail, FTP, www, Difference between www and Internet</p>
Unit 2 MS office	<p>Ms-Word: Usage of smart art tools, bookmark, cross-reference, hyperlink, mail merge utility and converting word as PDF files.</p> <p>Ms-Excel: Manipulating data, Working with charts, Advanced excel functions, Data Analysis using excel</p> <p>Power Point: Basics, Power point tools, shortcuts used in power point, Adding videos, recording the power points, choosing theme & style, adding animations & transitions, Making effective PPT</p>
Unit 3 Bioelectronics & Emerging Trends	<p>Introduction to Artificial Intelligence (AI), Machine Learning, Natural Language Processing (NLP), Robotics, Big data and its analysis, sensors, cloud computing, Introduction, types and Characteristics of bio-signals such as ECG,EEG,EMG,MEG signal acquisition and processing basics</p>
Unit 4 Cyber Law & Cyber Security	<p>Need of Cyber Law, History of Cyber Law in India</p> <p>Cyber Crimes: Various threats and attacks, Phishing, Key Loggers, Identity Theft, Call & SMS forging, e-mail related crimes, Denial of Service Attacks, Hacking, Online shopping frauds, Credit card frauds, Cyber Stalking</p> <p>Cyber Security: Computer Security, E-Security, Password Security and Reporting internet fraud</p>

UGBTGE 201 Fundamentals of Computers -References

1. Microsoft Office Professional 2013-Step by step 1 st edition, 15th May, 2013.
2. An Overview of Cyber Crime & security - Volume 1-1st Edition by Akash Kamal Mishra. Volume-I, 1st edition, 26th January, 2016
3. Computer Fundamental – Concepts, Systems & Application, P.K. Sinha

UGBTGE202 Fundamentals of Physics

Course Outcome	<p>Students will be able to -</p> <ul style="list-style-type: none"> • Understand core knowledge in physics, including the major premises of atomic physics, nuclear physics, optics, radiation physics, fluid dynamics. • Describe the structure of the atom, draw Bohr structure • State the location, relative charge, and atomic mass • Distinguish between the different types of radioactive decays • Use new knowledge in recognizing risks of radiation in their living and working environment • State the Newton's law of mechanics and fluid dynamics.
Unit 1 Basics of Atomic & Nuclear Physics	<p>Atomic Physics: (Review of Bohr's Postulate) Nuclear atom, Electron orbits, atomic spectra, Bohr atom, energy levels and spectra, correspondence principle, nuclear motion, atomic excitation.</p> <p>Radioactivity: Radioactive decay: Five kinds, Radioactivity and the Earth, Radiation Hazards, Half-Life, Radiometric Dating, Successive Disintegration $A \rightarrow B \rightarrow C$ (stable), Radioactive Series and Radioactive Equilibrium.</p> <p>Nuclear Physics: Nuclear composition, nuclear properties, Stable nuclei, Binding energy, Meson theory of nuclear forces</p>
Unit 2 Optics and Electromagnetism	<p>Optics- Properties of Light - Reflection, Refraction, Dispersion, Interference.</p> <p>Microscope- Construction and working principles of the following microscopes- Stereozoom (Dissecting), Fluorescent microscope, confocal microscope, Electron microscope- SEM, TEM (Principles).</p> <p>Magnetic Field, Types of magnets, Magnetism of Earth; Paramagnetism, Diamagnetism, Ferromagnetism, Nuclear Magnetism and Biomagnetism, Electromagnetic radiation</p>
Unit 3 Biophysics	<p>Introduction, Definition, History and scope of biophysics</p> <p>Viscosity: Definition Flow of Liquids through Capillaries; Stokes' Law; Terminal Velocity, Determination of 'η' by Falling Sphere Method; Viscosity Estimation by Oswald' Viscometer.</p> <p>Surface Tension: Definition - Surface Tension and Surface Energy; Capillary Action; Angle of Contact; Wettability; Temperature Dependence of Surface Tension. Relevance to life sciences and applications- Electrical properties of the cell, Action potential, Propagation of action potential, Methods of measurement of action potentials.</p>
Unit 4 Bio-Electronics	<p>Introduction, Types and Characteristics of bio-signals such as ECG, EEG, EMG, MEG signal acquisition and processing basics</p> <p>Recording system: Complete recording system for ECG, EMG, EEG.</p> <p>Artificial Intelligence, robotics, Big data and its analysis.</p>

UGBTGE 202 Fundamentals of Physics

1. Fundamentals of Physics, 9th edition, David Halliday, Robert Resnick
2. Perspectives of modern physics, Digitized edition (2007), Arthur Beiser
3. Biophysics, An Introduction, First Edition (2002), Cotteril R.
4. Textbook of optics and atomic physics, 8th edition (1989), P.P. Khandelwal
5. A Textbook of Optics, Brijlal Subrahmanyam
6. Principles of Instrumental Analysis, Douglas A. Skoog

F.Y.B.Sc.
Proposed Semester II Practicals

UGBTCP-201

Fundamentals of Biotechnology

1	Assignment- Study of any branch of Biotechnology and its applications
2	Assignment- Biotech company review
3	Preparation of one fortified food and its evaluation
4	Production and purification of enzyme
5	Immobilization of enzymes

UGBTCP-202

Biochemistry -1

1	Qualitative test for carbohydrates- Molisch, Benedicts, Iodine
2	Qualitative test for lipids- Solubility test, Grease test, Saponification, Hubl's iodine test, Salkowski's test.
3	Qualitative test for proteins - Biuret, Heat coagulation, Full and half saturation test, Ninhydrin test, Xanthoproteic test
4	Estimation of glucose by DNSA method
5	Estimation of protein by Biuret method
6	Effect of Substrate, enzyme concentration, temperature, pH and inhibitors on enzyme activity

UGBTGEP-201

Fundamentals of Computers

1	How to make power point presentations
2	Data representation using computers
3	Data analysis using Excel

UGBTGEP- 202

Fundamentals of Physics

1	Optical Activity of a Chemical Compounds by Polarimeter
2	Verification of Beer-Lambert's law
3	Components and working of Simple, Compound, Dark Field Microscope
4	Measurement of Viscosity by Poisseulis Method
5	Measurement of Viscosity by Viscometer and Density method
6	Measurement of E.M.F from different vegetables & vegetable waste
7	Measurement of magnetic susceptibility by Gouy's balance