Shri Vile Parle Kelavani Mandal's

MITHIBAI COLLEGE OF ARTS, CHAUHAN INSTITUTE OF SCIENCE & AMRUTBEN JIVANLAL COLLEGE OF COMMERCE AND ECONOMICS (AUTONOMOUS)

NAAC Reaccredited 'A' grade, CGPA: 3.57 (February 2016),

Granted under RUSA, FIST-DST & -Star College Scheme of DBT, Government of India,

Best College (2016-17), University of Mumbai

Affiliated to the

UNIVERSITY OF MUMBAI

Program: F.Y. B.Sc.

Course: Biotechnology

Credit Based Choice System (CBCS) with effect from the Academic year 2018-19

PROGRAMME SPECIFIC OUTCOMES (PSO'S)

On completion of the **B. Sc Biotechnology**, the learners should be enriched with knowledge and be able to-

PSO1: Understand Fundamentals of Biological sciences.

PSO2: Build a strong knowledge of Basics of cell , molecular biology, genetics, biochemistry, microbiology, Immunology

PSO3: Understand Scope and Application of Biotechnology for welfare of humans

PSO4: Comprehend Importance of Industrial and medical application of Biotechnology in day to day life

PSO5: Learn and master techniques required to handle and work in a biotechnology Laboratory

PSO6: Gain Awareness about existing and future applications of biotechnology in various branches

PSO7: Learn the Significance of environment its management, and need for sustainable development in future

PSO8: Develop a Well-rounded and confident personality with ability for smooth transition to industrial or research sector

Preamble

Twenty First Century is known as the Century of Biotechnology '. Biotechnology is one of the youngest branches of Life Science, which has expanded and established as an advanced interdisciplinary applied science in last few years. Biotechnology at the core envisages the comprehensive study of Life and the Interdisciplinary potential of Biotechnology has led to a unique status for Biotechnology in Research and Industry. The socio-economic potential of Biotechnology is well established which has almost become synonymous with modern development. Biotechnology has its applications in almost every field touching practically every human activity. The applied aspect of Biotechnology is now getting established with its applications in Industry, Agriculture, Health and Environment, Biotechnology is the lead science expanding exponentially. Biotechnology demands a trained, skilled human resource to establish the Industry and Research sectors. The field is novel and still expanding which demands inputs in Infrastructure and Technology. The global and local focus is on developing new technological applications is fast growing. Biotechnology sector in Research and Industry is expanding which is set to augur the next major revolution in the world. The demand for trained workforce in Biotechnology is ever growing in Fundamental Research and Industry Sector. Academic and Research Sectors also require interdisciplinary trained manpower to further the Biotechnology Revolution. The need of the hour is to design appropriate syllabi which keeps pace with changing times and technology with emphasizes on applications while elucidating technology in depth. The present Syllabi is Restructured anticipating the future needs of Biotechnology Sector with more emphasis on imparting hands-on skills. The main thrust is laid on making syllabus compatible with developments in Education, Research and Industrial sectors. The Theory and Practical course in new restructured course will lead to impart skill-set essentials to further Biotechnology Sector. The restructured syllabus combines basic principles of Physical, Chemical and Biological sciences in light of advancements in technology. The curriculum aims to impart basic knowledge with emphasis on its applications to make the students industry ready

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Evaluation Pattern

The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester end Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and Semester end Examinations is as shown below:

a) Details of Continuous Assessment (CA)

25% of the total marks per course:

Continuous Assessment	Details	Marks
Component 1 (CA-1)	**Test / Assignment/ Tutorial/ Visit/ Project/ Presentation**	15 marks
Component 2 (CA-2)	**Test / Assignment/ / Tutorial/ Visit/ Project/ Presentation**	10 marks

b) Details of Semester End Examination

75% of the total marks per course. Duration of examination will be two and half hours.

Question Number	Description	Marks	Total Marks
Q1.	Module I	20	20
Q2	Module II	20	20
Q3	Module III	20	20
Q4	Module I+II+ III	15	15
		Total Marks	**75**

Signature Signature Signature

HOD Approved by Vice –Principal Approved by Principal

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Biotechnology)				**Semester : 1**	
Course : Basic Biotechnology I				**Course Code: USMABT101**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks)**
3	**3**	**-**	**2+1**	**25**	**75**

Learning Objectives:

1. **To** acquaint students with history of biotechnology, its branches, traditional and modern biotechnology
2. To understand the various applications of biotechnology in the current scenario.
1.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Understand branches of biotechnology

CO2: Understand the applications agriculture, health care, environmental protection

CO3: Can visualize the scope of the subject and its future course of action

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	**Introduction, scope and applications of Biotechnology**	15
2	**Research and Extensions of Biotechnology**	15
3	**Introduction to Environmental Biotechnology**	15
	Total	**45**
PRACTICALS		**30**

Unit	Topic	No. of Hours/Credits
Module 1	**Introduction, scope and applications of Biotechnology** Scope and Introduction to Biotechnology History & Introduction What is Biotechnology? Definition of Biotechnology, Traditional and Modern Biotechnology, Branches of Biotechnology Plant, Animal Biotechnology, Marine Biotechnology, Agriculture, Healthcare, Industrial Biotechnology, Pharmaceutical Biotechnology, Environmental Biotechnology.	**15**
Module 2	**Research and Extensions of Biotechnology** Research and Extension Biotechnology in Developed and Developing Countries, World Scenario, Economic Importance, Biotechnology Research in India. Biotechnology Institutions in India (Public and Private Sector). Biotech Success Stories. Biotech Policy Initiatives Biotechnology in context of Developing World, Public Perception Biotechnology research In India, Future prospects	15
Module 3	**Introduction to Environmental Biotechnology** Environmental Biotechnology - Introduction Biofuels and Bioenergy , Renewable Energy: sources of renewable energy, Biogas technology, Bio fertilizers, Bio pesticides, Bioremediation	**15**

PRACTICALS of USMABT101

1. Isolation of Azotobacter,
2. Isolation of Rhizobium
3. Bioremediation
4. SCP- *Spirulina* and Mushroom

Suggested Readings

1. Biotechnology: Expanding Horizons / Singh, D :Kalyani Pub, 2007
2. Microbial Ecology: Fundamentals and Applicatio/ Atlas, Ronald .; Bartha, Richa. : Pearson Education, 2007
3. A Textbook Of Biotecnology Rep Edd / DubeyR .C. : S. Chand & Comp LTD
4. Principles Of Genetics 8th Edd / Gardner Eldon .J.: Wiley India, 2006
5. Advances in biotechnology: Himalaya Pub House, 2007
6. Environmental Biotechnology: Sheth Publishers, 2010
7. A Textbook of Biotechnology / Dubey, R. C. : S. Chand & Co., 2013

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Biotechnology)				**Semester : 1**	
Course : Basic Biotechnology II				**Course Code: USMABT 102**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks)**
3	**3**	**-**	**2+1**	**25**	**75**

Learning Objectives:

1. To acquaint students with the concept of genomes of prokaryotes and eukaryotes
2. To obtain knowledge of DNA packing and extrachromosomal DNA
3. To know the details of chromosomes, karyotypes, genes and alleles with inheritance of traits.
4. To study gene interactions and effect of various factors on gene expression

Course Outcomes:

After completion of the course, the student will have a detailed understanding of:

CO1: Understand the organization of genome in prokaryotes, eukaryotes and viruses
CO2: Know about organization of DNA in the chromosomes, coding and non coding portions of the DNA
CO3: Know about chromosome structure, banding and karyotypes and chromosomal disorders
CO4: Understand the basics of inheritance of traits, gene interactions and expression

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Concept of genes	**15**
2	Chromosomes structure and chromosomal disorders	**15**
3	Fundamentals of genetics	**15**
	Total	**45**
PRACTICALS		45

UNIT	DESCRIPTION	NO OF HOURS
Module 1	**Concept of genes** Central dogma : Introduction of the concept of central digma. Introduce the concept of DNA replication, transcription and translation and DNA structure. Structure and shapes of metaphase chromosomes, histone,nonhistone proteins, Nucleosome and packing of DNA into chromosome, types of DNA and topology	15
Module 2	**Chromosomes structure and chromosomal disorders** Chromosome banding, Karyotype analysis- Study of normal human karyotype, Study of genetic abnormalities – Turner's syndrome, Klinefelter's syndrome, Down's syndrome, Cri-du-chat, Philadelphia chromosome ,chromosomal aberrations	15
Module 3	**Fundamentals of genetics** Mendelian genetics, mono and di-hybrid crosses, Mendelian laws, Multiple alleles- blood groups, modifications of dominant relationships, gene interactions, essential and lethal genes, gene expression and environment – temperature, light, hormones, Alleles and their role in population studies, Polymorphism, Polymorphic disorders, pedigree analysis	15

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICALS of USMABT102

1. Karyotype Analysis
2. Study of Blood Groups
3. Problems on Mendelian genetics principles
4. Giemsa staining of DNA
5. Extraction of g-DNA from plant.

Suggested Readings

1. Genetics, (2006) - Strickberger MW - (Prentice Hall, India)
2. Human Genetics- A. M. Winchester – MacMillan Press
3. Essential iGenetics- Peter Russell - Pearson Education
4. Genetics (2012) – C. B. Powar Volume I and II– Himalaya Publishing House
5. Principles Of Genetics, 8th Edd / Gardner Eldon .J.: Wiley India, 2006
6. Lewin's GENES XII (2017) Jocelyn Krebs, Elliott Goldstein and Stephan Kilpatric - Oxford University Press
7. Principles of genetics (2011) – Dr. Peter Snustad and Michael Simmons, Willey Publications
8. Principles of Genetics, 7th Edition - Robert H Tamarin, McGraw Hill Publication

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Program: Bachelor of Science (Biotechnology)				**Semester : 1**	
Course : Basic Life Sciences I				**Course Code: USMABT 103**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks)**
3	**3**	**-**	**2+1**	**25**	**75**

Learning Objectives:

- To acquaint students with concept of microbial, plant and animal biodiversity

Course Outcomes:

After completion of the course, the student will have a detailed understanding of:

CO1: in identifying bacteria, fungi, plant and animal groups

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Microbial diversity-I	**15**
2	Plant diversity	**15**
3	Animal diversity	**15**
	Total	**45**
PRACTICALS		30

UNIT	DESCRIPTION	NO OF HOURS
Module 1	**Microbial diversity –I** Outline Classification: Prokaryotic and Eukaryotic microorganisms (5 major groups) Bacteria, Fungi, Cyanobacteria and viruses one example each Bacteria: Bacterial morphology and sub-cellular structures, general morphology of bacteria, shapes and sizes, generalized diagram of typical bacterial cell. .	15
Module 2	**Plant diversity** General & Unique features of plants as a category of living organisms. Introduction to plant groups and their characters with respect to increasing complexity in organization of plant body (Algae,Fungi, Bryophytes, Pteridophytes, Gymnosperms, Angiosperms with one example each) (Excluding plant taxonomy)	15
Module 3	**Animal diversity** Introduction to Kingdom: Animalia, -Outline classification of non-chordates and chordates with representative examples. Non-chordates: Honeybee: *Apis sp*. (Morphology, Mouthparts, Sting Apparatus, Structure of Head, Social Organization and Communication Parasitic association of *Plasmodium*, *Fasciola hepatica*, and *Taenia solium* Introduction to connecting links and development of Chordates	15

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PRACTICALS of USMABT103

1. Study of spirogyra, Fern, Hibiscus,
2. Study of different parts of plants - Anatomy of root, stem and leaf of a monocotyledon and dicotyledon
3. Study of plant tissue in T.S
4. Study of *Plasmodium sps. Fasciola sp.*
5. Mounting of mouth parts of Honey bee

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Suggested Readings

1. Microbiology–6th Edition (2006), Pelczar M.J., Chan E.C.S., Krieg N.R.
2. Presscott's Microbiology, 8th edition (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M Sherwood, Christopher J Woolverton, Chris Woolverton, McGrawHil Science Enginering, USA
3. General Principles of Microbiology- Stanier
4. Jordan, E.L. and Verma P.S. 1978, (i) Chordate Zoology S. Chand & Company Ltd. Ram Nagar. New Delhi.
5. Jordan, E.L. and Verma P.S. 1978 (ii) Invertebrate Zoology. S. Chand & Company Ltd. Ram Nagar. New Delhi.
6. Modern Text Book of Zoology: Invertebrates.R.L.Kotpal. Publisher, Rastogi

Publications, 2012.
7. Dutta A.C. (2000) A Classbook of Botany (Oxford University Press, UK)
8. Ganguli, Das Dutta (2011) – College Botany Vol I, II and III (New Central Book Agency, Kolkata

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Biotechnology)				**Semester : 1**	
Course : Basic Life Sciences II				**Course Code:USMABT104**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks)**
3	**3**	**-**	**2+1**	**25**	**75**

Learning Objectives:

- To introduce students to the basic concepts in organization, structure and function of prokaryotes and eukaryotes
- To introduce students to the importance and applications of basic microscopy as well as staining techniques in the study of microorganisms

Course Outcomes:

After completion of the course, the student will :

CO1: Gain knowledge of Struture of cells, microorganisms

CO2: Develop strong skills in microscopy

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Ultra structure of prokaryotic and eukaryotic cells	**15**
2	Cell organelle structure and differentiation	**15**
3	Microscopy and staining techniques	**15**
	Total	**45**
PRACTICALS		30

UNIT	DESCRIPTION	NO OF HOURS
Module 1	**Ultra structure of prokaryotic and eukaryotic cells** Prokaryotic Cell Structure and functions: Cell wall, Cell membrane, Components external to cell Wall-Capsule, Slime layer, Flagella, Pili, Fimbriae, Cytoplasmic Matrix- Inclusionbodies, magnetosomes, ribosomes,gasvesicles, Nucleoid,Plasmids, Bacterial endospores and their formation Eukaryotic Cell Structure: an Overview of Eukaryotic cell structure	15
Module 2	**Cell organelle-structure and differentiation** Cell structure, The plasma membrane and membrane structure Cytoplasmic matrix, microfilaments, intermediate filaments, and microtubules, Organelles of the Biosynthetic-secretory and endocytic pathways - Endoplasmic reticulum & Golgi apparatus. Definitions of Lysosome, Endocytosis, Phagocytosis, Autophagy, Proteasome. Eukaryotic ribosomes, Mitochondria, Chloroplasts; Nucleus—Nuclear Structure External Cell Coverings: Cilia and Flagella Comparison Of Prokaryotic And Eukaryotic Cells	15
Module 3	**Microscopy and staining techniques** Microscopy: History of microscopy, Optical spectrum, Lenses and mirrors: Simple and compound light microscope, Dark field Microscopy, Phase contrast Microscope. Dyes and stains: Types, Physico-chemical basis Fixatives, Mordants, Decolourizers. Simple and differential staining	15

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICALS of USMABT104

1. Introduction of Microbiology Laboratory Instruments
2. Aseptic Transfer technique
3. Wet mount of fungi
   Staining Techniques
4. Monochrome Staining
5. Gram staining
6. Spore Staining
7. Fungal Staining
8. Cell wall Staining
9. Capsule Staining

10. Microscopy – Components and working of Bright field compound microscope
11. Study of Photomicrographs of cell organelles

Suggested Readings

1. Prescott, L.M., Harley, J.P. and Klein, D.A. (2008) Microbiology, 5th Edition, McGraw-Hill, Boston
2. Salle A. J. (1973) Fundamental Principles of Bacteriology, 7th Edition, McGraw-Hill Book Co, New York and London
3. Talaro, K. P., & Chess B. (2012). Foundations in Microbiology, 8th Edition McGraw-Hill, Boston
4. Microbiology–6th Edition (2006), Pelczar M.J., Chan E.C.S., Krieg N.R., The McGraw Hill Companies Inc. NY

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Program: Bachelor of Science (Biotechnology)				**Semester : 1**	
Course: FYBSc				**Course Code: USMABT105**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
3	3	-	2+1	25	75

Learning Objectives:

To acquaint the students with basic concepts of sciences like chemical bonds, electrochemistry which can be used for developing sensors, and in separation of metallic and biomolecules

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Gain hands-on skills in preparation of Buffers and Solutions, understanding the instrumentation

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Chemical bonds and nomenclature	15
2	Water and buffers	15
3	Principles of Electrochemistry	15
	Total	**45**
PRACTICALS		**30**

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICAL USMABT105

1. Safety Measures and practices in Chemistry Laboratory
2. Reagents preparation and Biochemical Calculation
3. Preparation of Molar, Molal and Normal solution
4. Preparation of Buffers
5. Determination the strength of HCl
6. Determination of strength of Acetic acid
7. Qualitative Analysis of Inorganic Compounds

8. Organic qualitative analysis of compounds containing C,H,(O)
9. Standardize commercial sample of NaOH using KHP

UNIT	DESCRIPTION	NO OF HOURS
Module 1	**Chemical bonds and nomenclature**	**15**
	Ionic Bond: Introduction to IUPAC nomenclature 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_2O, Shapes of $BeCl_2$, BF_3 **Coordinate Bond:** Nature of Coordinate Bond Non-Covalent Bonds: VanDerWaal '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	
Module 2	**Water and buffers**	**15**
	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 Solutions: Normality, Molarity, Molality, Mole fraction, Mole concept, Solubility, Weight ratio, Volume ratio, Weight to Volume ratio ppb, ppm, milli moles, milli-equivalents (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.	
Module 3	**Principles of Electrochemistry**	**15**
	Concept of electrochemistry, EMF and its measurements, single electrode potentials, calculation, classification of electrodes, amalgam, gas, metal/insoluble salt and oxidation and reduction electrodes, electrochemical cells, application of electrochemistry in the biological component assessment and development of sensors.	

10. Determination of the amount of Mg (II) present in the given solution
11. Functioning and Standardization of pH meter
12. Graphical Representations using Excel

Suggested Readings

1. University General Chemistry, 1st edition (2000), C.N. R. Rao, Macmillan Publishers, India.
2. Physical Chemistry University for biological sciences, 1st edition, (2005), Chang R., Science Books, USA
3. Essentials of Physical Chemistry, 24th edition, (2000), B S Bahl, G D Tuli, Arun Bahl, S. Chand Limited, India.
4. Concise Inorganic Chemistry .5th edition (2008), Author: J. D. Lee, John Wiley & Sons, USA.
5. Organic Chemistry, 6th edition, (1992), Morrison Robert Thornton, Pearson Publication, Dorling Kindersley (India Pvt. Ltd.)
6. University Physics, Sears' and Zemansky' Pearson Education ,2013

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Program: Bachelor of Science (Biotechnology)				**Semester : 1**	
Course : Bioorganic Chemistry-I				**Course Code: USMABT106**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks)**
3	**3**	**-**	**2+1**	**25**	**75**

Learning Objectives:

The objective of the course is to make students aware of the major classes of important compounds in living organisms introducing them to the foundation of biochemistry, in terms of understanding the significance and role of carbohydrates, lipids, and nucleic acids

Course Outcomes:

After completion of the course, the student will have a detailed understanding of:

CO1: Understand the structure, properties and functions of important biomolecules from carbohydrates, lipids, and nucleic acids

CO2: Correlate the properties and apply the same during for other courses such as molecular biology and cell biology.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Carbohydrates	**15**
2	Lipids	**15**
3	Nucleic Acids	**15**
	Total	**45**
PRACTICALS		30

UNIT	DESCRIPTION	NO OF HOURS
Module 1	**Carbohydrates** Carbohydrates D & L Glyceraldehydes, structure of monosaccharide, disaccharides, and polysaccharides. Isomers of mono-saccharides, chemical/physical properties of carbohydrate, chemical reactions for detection of mono, di And polysaccharides Definition, Classification, Biological role. Mono-saccharides, oligosaccharides (Maltose, Cellobiose, Sucrose, Lactose) and polysaccharide (Starch, Glycogen, Peptidoglycan, Cellulose)	15
Module 2	**Lipids** Fatty acids as basic component of lipids and their classification nomenclature, storage lipids and structural lipids. Types of lipids with general structure of each and mention examples	15
Module 3	**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	15

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICALS of USMABT106

1. Determination of Iodine value of oil & Acid value of oil.
2. Separation of fatty acids by TLC
3. Qualitative test for Carbohydrates
4. Qualitative test for Nucleic Acids

Suggested Readings

1. Lehninger, Principles of Biochemistry. 5th Edition (2008), David Nelson & Michael Cox, W.H. Freeman and company, NY
2. Biochemistry, U Satyanarayana 2nd edition Books and Allied pvt Ltd
3. Outlines of Biochemistry: 5th Edition, (2009), Erice Conn & Paul Stumpf ; John Wiley and Sons, USA
4. Fundamentals ofBiochemistry, Jain,J. L.S. Chand &co., 2013
5. Fundamentals of Biochemistry. 3rd Edition (2008), Donald Voet& Judith Voet , John Wiley and Sons, I. USA
6. Harper's Illustrated Biochemistry, Twenty-Eighth Edition, Robert K. Murray, et.al.The McGraw-Hill Companies, Inc

7. An Introduction to Practical Biochemistry.3rd Edition, (2001), David Plummer, Tata McGraw Hill Edu.Pvt.Ltd. New Delhi, India

Program: Bachelor of Science (Biotechnology)				**Semester : I**	
Course : Environment management studies (Ability Enhancement Course)				**Course Code: USMABT 107**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE)**	**Term End Examinations (TEE) (Marks in Question Paper)**
03	**-**		**02**	**25 Marks**	**75 Marks**

Learning Objectives:

1. To acquaint students with various components of the environment , its problems , and various practices that can be carried to maintain the ecosystem.
2. To impart knowledge of environmental biotechnology and its use environmental protection and understanding various environmental policies with the scope of the subject

Course Outcomes:

After completion of the course, students would be able to :
CO 1: Understand the importance of environment
CO2 : Accepts the need to reduce environmental pollution
CO 3: shape into a responsible citizen with knowledge of environmental policies and practices

Outline of Syllabus: (per session plan)

Module	**Description**	**Duration**
1	Environment and Ecosystem	15
2	Environmental Pollution	15
3	Environmental policies and Practices	15
	Total	45
PRACTICALS		
	Nil	

UNIT	DESCRIPTION	NO OF HOURS
1	**Environment and Ecosystem** Components of Environment - definitions with examples, Interaction of man and environment, Environmental studies as a multidisciplinary subject. Ecosystem: Structure, function and types of ecosystems; ecological succession, food chain and food web	**15**
2	**Environmental Pollution** Environmental pollution Air Pollution and Air Pollution Monitoring and Control. Water Pollution : Eutrophication; Assessment of Water Quality-Pollutant Monitoring and Control; Soil and Solid Waste Pollution : Occupational Hazards and Control. Soil Erosion : Concept, Causes and Effects. Solid waste management: Control measures of urban and industrial waste. Pollution case studies	**15**
3	**Environmental policies and Practices** Global Environmental Problems and Issues Green House Gases and Green House Effect Global Warming;Ozone Depletion; Kyoto Protocol;UV Radiation; Acid Rain. Environment Laws : Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution)	**15**
	Total	**30 Hours**

Suggested readings:

Text Books:

1 Environmental biotechnology basic concepts and applications by Indushekhar Thakur
2 Environmental biotechnology by M.H Fulekar
3 Environmental biotechnology by Alan Scragg
4 Environmental biotechnology theory and applications (2nd Edition) by Gareth G.Evans and Judy Furlong.

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Biotechnology)				**Semester : 2**	
Course: Biotechnology I				**Course Code: USMABT201**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks)**
3	**3**	**-**	**2+1**	**25**	**75**

Learning Objectives:

To acquaint students with food biotechnology, food processing and quality control.

Course Outcomes:

After completion of the course, the student will have a detailed understanding of:

CO1: To impart the knowledge of use of microorganisms in food preparation, preservation and spoilage.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Introduction to food biotechnology	**15**
2	GMO applications of biotechnology	**15**
3	Introduction to industrial biotechnology	**15**
	Total	**45**
PRACTICALS		30

UNIT	DESCRIPTION	NO OF HOURS
Module 1	**Introduction to Food Biotechnology** Food Biotechnology, Biotechnological applications in enhancement of Food, Quality Unit Operation in Food Processing, Quality Factors in Pre-processed, 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 Food Microbiology a. Scope of Food Microbiology and role of microbiologist in food Industry b. General Principles of Spoilage and Contamination of Food c. General principles of Preservation of Food	15
Module 2	**GMO Applications of Biotechnology** in Agriculture : GM Food, GM Papaya, GM Tomato, Fungal and Insect Resistant Plants BT Crops, BT Cotton and Bt Brinjal ,Pros and Cons Biotechnological applications in Crop and Livestock Improvements Modifications in Plant Quality Golden Rice ,Molecular Pharming, Plant Based Vaccines Ethics in Biotechnology and IPR	15
Module 3	**Introduction to Industrial biotechnology** Fermenter and media Basic design of a fermenter-baffles spargers, impeller. Media composition — Water, energy sources, carbon, nitrogen, minerals, growth factors, buffers, precursors, inducers, antifoams. Inoculum and production media	15

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICALS of USMABT201

1. Production of alcohol by yeast
2. MIC for sugar
3. MIC for salt
4. Isolation of microorganisms from food spoilage
5. Isolation of Lactic acid bacteria
6. Isolation of Casein from milk

Suggested Readings

1. Adam M, Dick M. Food microbiology-An introduction
2. Sambamurthy K and AushotoshKar, 2006. Pharmaceutical biotechnology. New age international publishers
3. Food Microbiology- Frazier 4th edition, Tata McGraw Hill publication, 2005.
4. Industrial Microbiology- A. H. Patel
5. Industrial Microbiology- L. E. Casida- John Wiley & Sons

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Biotechnology)				**Semester : 2**	
Course: Biotechnology-II				**Course Code: USMABT202**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks)**
3	**3**	**-**	**2+1**	**25**	**75**

Learning Objectives:

1. To acquaint students with the DNA replication in various organisms and its types
2. To acquaint students with microbial genetics
3. Study types of mutations and mutagenic agents with their action.
4. To know the mechanisms of DNA repair in the cell

Course Outcomes:

After completion of the course, students would be able to :

CO1: Understand the mechanism of DNA replication in prokaryotes and eykaryotes,
CO2: Know the genetic transfer mechanisms in bacteria
CO3: Understand action of mutagenic agents and know the types of mutations.
CO4: Know the cellular repair mechanisms

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	DNA replication	**15**
2	Microbial genetics	**15**
3	DNA mutations and DNA repair	**15**
	Total	**45**
PRACTICALS		30

UNIT	DESCRIPTION	NO OF HOURS
Module 1	**DNA replication** Semi-conservative mode of replication, Messelson and Stahls experiment: Enzymology of DNA synthesis, Initiation, elongation, termination of replication Types of replication – Semi discontinuous, rolling circle, Bi-directional, looped rolling circle. Endo replication, Replication in Prokaryotes and Eukaryotes.	15
Module 2	**Microbial genetics** Genetic transfer mechanisms in bacteria-Transformation – Griffith's experiment, Conjugation– Davis's Experiment, Transduction – basic concept	15
Module 3	**DNA mutations and DNA repair** Mutations – Types, mutagens, types of mutagens, molecular basis of mutagenesis, reversion, induced& spontaneous mutations, silent mutations, Chromosome aberrations ,polymorphism disorders, DNA repair Photo-reversal, Base Excision Repair, Nucleotide Excision Repair, Mismatch Repair, SOS Repair and Recombination Repair.	15

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICALS of USMABT202

1. Study of chromosomal aberrations.
2. Study of GMOs
3. Study of Giant chromosomes
4. Isolation of polytene chromosomes from Chironomous larvae
5. Estimation of DNA by DPA method
6. Effect of UV on growth of bacteria
7. Effect of Colchicine on cell division

Suggested Readings

1. Genetics, (2006) - Strickberger MW - (Prentice Hall, India)
2. Human Genetics- A. M. Winchester – MacMillan Press
3. Essential iGenetics- Peter Russell - Pearson Education
4. Genetics (2012) – C. B. Powar Volume I and II– Himalaya Publishing House
5. Principles Of Genetics, 8th Edd / Gardner Eldon .J.: Wiley India, 2006
6. Lewin's GENES XII (2017) Jocelyn Krebs, Elliott Goldstein and Stephan Kilpatric - Oxford University Press
7. Principles of Genetics, 7th Edition - Robert H Tamarin, McGraw Hill Publication

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Biotechnology)				**Semester : I**	
Course: LIFE Sciences -1				**Course Code: USAMBT 203**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
3	2		2+1	25	75

Learning Objectives:

1. **To** acquaint students with concept of microbial ecosystems,
2. **To enable the student to have clear concepts of** plant physiology
3. To understand the nuances of animal physiology to evaluate and create scientific models

Course Outcomes:

After completion of the course, learners would be able to:

CO2: Assess the microbial components and diversity with reference to the environment they survive.

CO3: understand the physico chemical factors associated with physiology of the plants and animals

CO4: Role of abiotic factors in the survival of the life.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	**Microbial Ecology**	15
2	**Plant physiology**	15
3	**Animal physiology**	15
	Total	**45**
PRACTICALS		

Unit	Description	No. of Hours
Module 1	**Microbial Ecology** Ecosystem &Interactions, Hydrosphere, Atmosphere, Lithosphere Aquatic –freshwater and marine, terrestrial ecosystems. Biotic interactions- Mutualism, predation, parasitism, commensalism, symbiosis, competition, ammensalism, neutrality.	**15**
Module 2	**Plant physiology** Plant cell biology – Unique features of a plant cell, Cell wall Anatomy – Internal organization of vegetative and reproductive plant organs (leaf, shoot, root and flower) b) Functional- Permeability Diffusion – Definition, significance, mechanism, laws and factors affecting diffusion Osmosis – Definition, mechanism, significance, osmotic pressure (OP), types of osmosis –endosmosis, ex-osmosis, turgor pressure(TP) and wall pressure (WP), relation between OP, DPD (Suction pressure) and TP Absorption and adsorption of water Ascent of sap – Introduction and mechanism (Capillarity, Imbibition, Atmospheric pressure and Cohesion-tension)	15
Module 3	**Animal physiology** Animal Tissues (Histology)-Introduction and Types with example. Muscle and nerve cell structure, synaptic transmission and neuro-muscular junctions. Anatomy and Physiology: Circulatory System (Heart, Arterial, Venous and Portal Systems Blood pigments: Role in oxygen transport, Oxygen dissociation curves and their physiological significances, Transport of CO_2), Lymphatic system, Nervous System (CNS, PNS, ANS), and Sense Organs, Musculo-skeletal System, Urino-genital System, Endocrine and Reproductive system Chemical communication: Various types of communication systems with an emphasis on endocrine hormones and their action (Pituitary and Adrenal glands) Neuro-anatomy and Neurophysiology	**15**

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICALS of USMABT203

1. Study the process of Osmosis and Turgor pressure
2. Study of buccal epithelial cells
3. Study of respiratory, circulatory, excretory systems in animal with photograph
4. Biotic interactions – Assignment

Suggested Readings

1. Text book of Medical Physiology,Guyton,
2. Concise Medical Physiology- Sujit K Chaudhari
3. Human Physiology- Guyton –International Edition
4. Human Anatomy- Marieb
5. Devlin R.M. (1983) - Fundamentals of Plant Physiology (Mac. Millan, New York)
6. Dutta A.C. (2000) A Classbook of Botany (Oxford University Press, UK)
7. Ganguli, Das Dutta (2011) – College Botany Vol I, II and III (New Central Book Agency, Kolkata)

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Biotechnology)				**Semester : 2**	
Course: Life Sciences II				**Course Code: USMABT204**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks)**
3	**3**	**-**	**2+1**	**25**	**75**

Learning Objectives:

- To introduce students to the basic concepts in microbial nutrition and microbial growth
- To provide students with the knowledge of different physical and chemical methods for the control of microorganisms

Course Outcomes:

After completion of the course, the student will have a detailed understanding of:

CO1: Overview of the biochemical events in carbohydrate and lipid biosynthesis and its regulation

CO2: The functions of group I and group II hormones, their mechanisms of action and the disorders associated with abnormal endocrine functions of the various glands

CO3: Relationship between regulation of major metabolic pathways and endocrine control

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Introduction to microbial nutrition and sterilization techniques	**15**
2	Microbial growth and enumeration	**15**
3	Cell cycle and mitosis	**15**
	Total	**45**
PRACTICALS		30

UNIT	DESCRIPTION	NO OF HOURS
Module 1	**Introduction to Microbial nutrition** Nutritional requirements — Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulphur and growth factors. Nutritional types of microorganisms, Types of Culture media with examples Isolation of microorganisms and pure culture techniques Preservation of microorganisms **Sterilization techniques** Control of Microorganisms: Definition of frequently used terms & Rate of microbial death, Properties of an ideal disinfectant Evaluation of disinfectant Physical methods of microbial control Chemical methods of microbial control	15
Module 2	**Microbial growth and enumeration** Microbial Growth: A .Definition of growth, Mathematical Expression, Growth curve b. Measurement of growth c. Direct microscopic count —Breed's count, Petroff—Hausser counting chamber-Haemocytometer. d. Viable count — Spread plate and Pour plate technique e. Measurements of cell constituents. Turbidity measurements —Nephelometer and spectrophotometer techniques	15
Module 3	**Cell cycle and mitosis** general events of interphase, prophase, metaphase, anaphase, telophase, cytokinesis, physiology of cell cycle and mitosis, significance of mitosis; meiosis and reproductive cycle, kinds of meiosis, process of meiosis, heterotypic division or first meiotic division, homo-typic or second meiotic division; significance of meiosis; comparison of mitosis and meiosis. cell cycle and check points, Cell division in bacteria viruses and protozoans, binary fission, syngamy, fusion, budding, autogamy	15

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICALS OF USMABT204

1. Preparation of culture media
2. Enrichment Techniques- Winogradsky's column
3. Determination of Diffusion pressure Deficit using potato tubers
4. Bacterial growth in response to Oxygen availability
5. Nephlometry,

6. Direct microscopic count-Breed's count
7. Bacterial Growth curve
8. Study of mitosis by squash method using Onion root tips)
9. Study of meiosis
10. Types of cell division using photomicrographs

Suggested Readings

1. Prescott, L.M., Harley, J.P. and Klein, D.A. (2008) Microbiology, 5th Edition, McGraw-Hill, Boston
2. Talaro, K. P., & Chess B. (2012). Foundations in Microbiology, 8th Edition McGraw-Hill, Boston
3. Microbiology–6th Edition (2006), Pelczar M.J., Chan E.C.S., Krieg N.R., The McGraw Hill Companies Inc. NY

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Biotechnology)				**Semester: II**	
Course: Chemistry I– Physical Chemistry				**Course Code: USMABT205**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks)**
3	**3**	**-**	**2+1**	**25**	**75**

Learning Objectives:

To acquaint the students with basic concepts of sciences like chemical bonds, electrochemistry which can be used for developing sensors, and in separation of metallic and biomolecules

Course Outcomes:

After completion of the course, the student will have a detailed understanding of:

CO1: Titrimetric and Volumetric Estimations and \

CO2: Handling of basic Analytical Techniques like Chromatography and Colorimetry

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Physical Chemistry	15
2	Stereochemistry	15
3	Introduction to analytical techniques	15
	Total	**45**
PRACTICALS		**30**

Unit	Description	No. of Hours
Module 1	**Physical Chemistry**	**15**
	Thermodynamics: System, Surrounding, Boundaries Sign Conventions, State Functions, Internal Energy and Enthalpy: significance, examples, (Numericals expected.) Laws of Thermodynamics and its Limitations, Laws of Thermodynamics as applied to Biochemical Systems. Concept of Entropy, Entropy for Isobaric, Isochoric and Isothermal Processes **Reaction Kinetics:** Rate of Reaction, Rate Constant, Measurement of Reaction Rates Order & Molecularity of Reaction, Integrated Rate Equation of First and Second order reactions. determination of Order of Reaction by a) Integration Method b) Graphical Method c) Ostwald 's Isolation Method d) Half Time Method. (Numericals expected). **Principals of Oxidation & Reduction Reactions**– Oxidising and Reducing Agents, Oxidation Number, Rules to assign Oxidation Numbers with examples Ions like (e.g. -Oxalate, Permanganate and Dichromate.) Balancing Redox Reactions by Ion Electron Method Oxidation, Reduction, Addition and Substitution & Elimination Reactions	
Module 2	**Stereochemistry**	**15**
	Isomerism – Types of Isomerism: Constitutional Isomerism (Chain, Position and Functional) and Stereo-isomerism, Chirality. Geometric Isomerism and Optical Isomerism : Enantiomers, Dia- stereomers, and Racemic Mixtures Cis, Trans, Threo, Erythro and Meso-isomers,.Dia-stereomerism (Cis-Trans Isomerism) in Alkenes and Cycloalkanes (3 and 4 membered ring) Conformation: Conformations of Ethane. Difference between Configuration and Conformation. .Configuration, Asymmetric, Stereogenic / Chiral Centers, Chirality Representation of Configuration by ―Flying Wedge Formula‖ Projection formulae – Fischer, Newman and Sawhorse.The Inter-conversion of the Formulae.	
Module 3	**Introduction to analytical techniques**	**15**
	Titrimetric Analysis: Titration, Titrant, Titrand, End Point, Equivalence Point, Titration Error, Indicator, Primary and Secondary Standards,	

	Characteristics and examples Types of Titration, Theory of Acid –Base Indicators, Choice and Suitability of Indicators. **Gravimetric Analysis:** Solubility and Precipitation, Factors affecting Solubility, Nucleation, Particle Size, Crystal Growth, Colloidal State, Ageing/Digestion of Precipitate. Co-Precipitation and Post-Precipitation. Methods of Separation Precipitation, Filtration, Distillation and Solvent Extraction. **Analytical Techniques** Chromatography: Definition, Principles, Types, Introduction to Paper Chromatography, Thin Layer Chromatography, Column Chromatography and its applications. Colorimetry: Principle, Beer-Lambert's Law, Filter Selection	

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICALS of USMABT205

1. Find specific rotation of optically active compound (Glucose/ Sucrose) using Polarimeter
2. Study inversion of Cane sugar.
3. Determination the amount of $NaHCO_3$ + Na_2CO_3 in the given solid mixture
4. Determination the amount of NH_4Cl+ $BaSO_4$ in the given solid mixture
5. Separation of Cu, Ni and Fe using paper chromatography
6. Separation of Amino acid using Paper chromatography
7. Study of $NaHCO_3$ + Na_2CO_3 indicator, double indicator
8. Estimation of Barium as $BaSO_4$ gravimetrically
9. Estimation of Ferric as Fe_2O_3gravimetrically
10. Viscosity measurement using Ostwald's' viscometer (for known and unknown viscosity)
11. Verification of Beer and Lambert's Law – a. Components and working of Colorimeter and Spectrophotometer using $KMnO_4$, $CuSO_4$

Suggested Readings

1. Fundamentals of Analytical Chemistry 8th edn / Skoog. : Thomson Learning, 2004
2. University General Chemistry, 1st edition (2000), C.N. R. Rao, Macmillan Publishers, India.
3. Physical Chemistry University for biological sciences, 1st edition, (2005), Chang R., Science Books, USA
4. Essentials of Physical Chemistry, 24th edition, (2000), B S Bahl, G D Tuli, Arun Bahl, S. Chand Limited, India.
5. Concise Inorganic Chemistry .5th edition (2008), Author: J. D. Lee, John Wiley & Sons, USA.
6. Organic Chemistry, 6th edition, (1992), Morrison Robert Thornton, Pearson Publication, Dorling Kindersley (India Pvt. Ltd.)
7. University Physics, Sears' and Zemansky' Pearson Education ,2013

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science (Biotechnology)				**Semester : 2**	
Course: Bioorganic Chemistry II				**Course Code: USMABT 206**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks)**
3	**3**	**-**	**2+1**	**25**	**75**

Learning Objectives:

The objective of the course is to make students aware of the major classes of important compounds in living organisms introducing them to the foundation of biochemistry, in terms of understanding the significance and role of amino acids, proteins , enzymes and Vitamins

Course Outcomes:

After completion of the course, the student will have a detailed understanding of:

CO1: Understand the structure, properties and functions of important biomolecules from amino acids, proteins, enzymes and Vitamins

CO2: Correlate the properties and apply the same during for other courses such as molecular biology, and metabolism

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Proteins	
2	Vitamins and coenzymes	**15**
3	Introduction to enzymes	**15**
	Total	**45**
PRACTICALS		30

UNIT	DESCRIPTION	NO OF HOURS
Module 1	**Proteins** Classification based on Structure and Functions, with e.g. N-terminal (Sanger and Edmans Method) and C-terminal Analysis (Enzyme) Denaturation of protein, **Amino acids** Classification based on polarity, R group, Charge, and nutritional requirements Preparation and Properties, Isoelectric Point, Peptide Synthesis. Titration Curve of Amino Acids. Concept of Isoelectric pH, Zwitterion. Reactions of Amino acids	15
Module 2	**Vitamins and coenzymes** Vitamin A, D, E, K — structure ,function; Water soluble vitamins—function and gross structure; Co enzymes-thiamine, riboflavin, folic acid, pyridoxine, B-12,niacin,pantothenicacid, biotin, Vitamin C ,Lipoic acid, Cynacobalamine	15
Module 3	**Introduction to enzymes** Enzymes: classification. Basic concept, active site, energy of activation. Transition state hypothesis, Lock and key hypothesis, induced fit hypothesis. Michaelis-Menten equation, Line weaver-Burk plot equation. Allosteric enzymes, Enzyme inhibition.	15

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

PRACTICALS OF USMABT206

1. Estimation of Vitamin C by DCPIP method
2. Qualitative test for Proteins
3. Estimation of protein by Biuret method
4. Estimation of sugars by DNSA method
5. Enzyme assay (Amylase): Effect of pH
6. temperature
7. substrate concentration
8. enzyme concentration
9. Enzyme Kinetics of β amylase

Suggested Readings

1. Lehninger, Principles of Biochemistry. 5th Edition (2008), David Nelson & Michael Cox, W.H. Freeman and company, NY
2. Biochemistry, U Satyanarayana 2nd edition Books and Allied pvt Ltd
3. Outlines of Biochemistry: 5th Edition, (2009), Erice Conn & Paul Stumpf ; John Wiley and Sons, USA
4. Fundamentals ofBiochemistry, Jain,J. L.S. Chand &co., 2013

5. Fundamentals of Biochemistry. 3rd Edition (2008), Donald Voet& Judith Voet , John Wiley and Sons, I. USA
6. Harper's Illustrated Biochemistry, Twenty-Eighth Edition, Robert K. Murray, et.al.The McGraw-Hill Companies, Inc
7. An Introduction to Practical Biochemistry.3rd Edition, (2001), David Plummer, Tata McGraw Hill Edu.Pvt.Ltd. New Delhi, India

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Batchelor of Science (Biotechnology)				**Semester : II**	
Course : Environmental studies – Sustainable Development				**Course Code: USMABT207**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE)**	**Term End Examinations (TEE) (Marks- 75 in Question Paper)**
03	**-**	**-**	**02**	**25 Marks**	**75 Marks**

Learning Objectives:

. To acquaint students with various components of the environment , conservation methods, and various practices that can be carried to maintain the ecosystem.

. To impart knowledge of environmental biotechnology for sustainable development and conservation of resources.

Course Outcomes:

After completion of the course, students would be able to :
CO1: Understand the useof conservation methods
CO2: consider the ethical issues and need for the environmental sustainability
CO3 : develop public awareness among the people

Outline of Syllabus: (per session plan)

Module	**Description**	**No of hours**
1	Natural Resources: Renewable and Non-renewable Resources	15
2	Biodiversity and Conservation	15
3	Human Communities and the Environment	15
	Total	**45**
PRACTICALS		
	Nil	

DETAILED SYLLABUS		
Module	**Description**	**No of hours**
1	**Natural Resources: Renewable and Non-renewable Resources** Land Resources and land use change; Land degradation, soil erosion and desertification; Deforestation; biodiversity and tribal populations. Water: Use and over-exploitation , floods, droughts, conflicts Heating of earth and circulation of air; air mass formation and precipitation. Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies. Biosensors for environmental monitoring; biosafety from GMO's, Biomining and methods in biomining	**15**
2	**Biodiversity and Conservation** Levels of biological diversity :genetic, species and ecosystem Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots Nature reserves India as a mega-biodiversity nation; Endangered and endemic species of India Threats to biodiversity, Ecosystem and biodiversity services Laws of biodiversity protection:	**15**
3	**Human Communities and the Environment** Business of biotechnology- use of biotechnology , patents and biotechnology;areas of public concern ; environment application of biotechnology- treatment of wastes and soil remediation;immune chemical applications of biotechnology- immunisation,monoclonal antibodies, invivo and invitro use of monoclonal antibodies; biotransformations- biocatalyst and its use in non-conventional media	**15**
	Total	**45**

Suggested readings:

1. Environmental biotechnology by M.H Fulekar
2. Basic Biotechnology by Colin Ratledge and Bjorn Kristiansen
3. Environmental biotechnology basic concepts and applications by Indushekhar Thakur