Academic Council dated 15th July, 2023 as per Item Number: 1.03

DOMBIVLI SHIKSHAN PRASARAK MANDAL'S

K.V. PENDHARKAR COLLEGE OF ARTS, SCIENCE AND COMMERCE, (AUTONOMOUS) DOMBIVLI (EAST), DIST. THANE

(Affiliated to University of Mumbai)

Faculty of Science

DEPARTMENT OF BIOTECHNOLOGY

(Programme: Bachelor of Science, B.Sc.)

SYLLABUS FOR

F. Y. B.Sc. – Biotechnology (Semester I and II)

Choice Based Credit System (CBCS)

As Per NEP 2020

(With effect from the Academic Year: 2023-2024)

Ms. Sandeeptha Rathindran
BoS Chairperson

Prof. (Dr.) K.R. Jagdeo
I/C Principal

Semester – I						
Sr. No.	**Course Code**	**Course Title**	**Category**	**Teaching hours/ week**	**Total Marks**	**Credits**
1.	BT23101MM	Introduction to Biotechnology	Major Mandatory 1	3	100	2
2.	BT23102MM	Microbial Techniques	Major Mandatory 2	3	100	2
3.	BT23103MM	Practical Paper 1 (Practical of BT23101MM + BT23102MM)	Major Mandatory 3	6	100	2
4.	BT23104MN	Molecular Biology	Minor	3	100	2
5.	BT23105OE	Biodiversity and Cell Biology	Open Elective 1	3	50	2
6.	MS23104OE	General Management– I	Open Elective 2	3	50	2
7.	BT23107VS	Biomolecules	VSC	3	100	2
8.	BT23108SE	Practical Paper 2 (Practical of BT23104MN+BT23105OE+ BT23107VS)	SEC	6	100	2
9.	BT23109AE	Foundation Course I	AEC	3	50	2
10.	BT23110VE	Communication Skills and Scientific Writing	VEC	3	50	2
11.	BT23111IK	Glorious Scientific Tradition of India	IKS	3	50	2

Semester –II						
Sr. No.	**Course Code**	**Course Title**	**Category**	**Teaching hours/ Week**	**Total Marks**	**Credits**
1.	BT23201MM	Physiology and Ecology	Major Mandatory 1	3	100	2
2.	BT23202MM	Enzymology, Immunology and Biostatistics	Major Mandatory 2	3	100	2
3.	BT23203MM	Practical Paper 1 (Practical of BT23201MM + BT23202MM)	Major Mandatory 3	6	100	2
4.	BT23204MN	Genetics	Minor	3	100	2
5.	BT23205OE	Basic Chemistry	Open Elective 1	3	50	2
6.	CS23205OE	Web Application Development	Open Elective 2	3	50	2
7.	BT23207VS	Tissue Culture & Dairy Technology	VSC	3	100	2
8.	BT23208SE	Practical paper 2 (Practical of BT23204MN + BT23205OE+ BT23207VS)	SEC	6	100	2
9.	BT23209AE	Basic Computer knowledge	AEC	3	50	2
10.	BT23210VE	Environmental sciences	VEC	3	50	2
11.	BT23211CC	NSS/NCC/ Cultural Activities/ Community Work/ Small Project pertaining to achievements of India in different fields	CC	3	50	2

SEMESTER – I

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23101MM	**INTRODUCTION TO BIOTECHNOLOGY**	**Major Mandatory 1**	**2**

Course Objectives: To acquaint students with the various fields in Biotechnology, different applications of Biotechnology & an understanding of Agriculture, Food & Fermentation Biotechnology.

Learning Outcome: At the end of this course the student would have a good understanding of:

- The field of Biotechnology, its scope and applications.
- Well familiar with a very important aspect of Agriculture biotechnology.
- Basic of Food biotechnology with food processing technology & Fermentation Techniques with industrial application and scope.

Unit I **Scope and Introduction to Biotechnology**	History, Introduction and Scope of Biotechnology, Branches of Biotechnology Biotechnology Institutions in India (Public and Private Sector), Biotechnology Research in India, Biotech Success Stories, Biotechnology in context of Developing World, Public Perception of Biotechnology, Ethics in Biotechnology	10 Hours
Unit II **Agricultural Biotechnology**	Genetically Modified Crops GM Technology for Improved Nutritional quality: Golden rice GM Technology for Biotic stress: Pest resistant plant GM Technology for Abiotic stress: Salt, cold and drought resistant plant Molecular Pharming in plants	10 Hours

Unit III **Food and Fermentation Biotechnology**	Food Biotechnology: Biotechnological applications in enhancement of Food Quality, Unit Operation in Food Processing, Quality Factors in Preprocessed Food Food Deterioration and its Control, Microbial role in food products Fermentation Technology: Definition, Applications of Fermentation Technology Overview of Microbial Fermentations: Acetic Acid, Citric Acid, Antibiotics, Enzymes and Beverages	10 Hours

Learner's space:

Collecting information on Biotechnology industries in India and abroad, interviewing an entrepreneur in biotechnology sector, developing model of genetically modified organism, gathering information on GM tomatoes, virus resistant plant, and plant based vaccines. Modern Biotechnological Regulatory Aspects in Food Industries.

Reference Books:

1. Advanced Biotechnology, 1st edition by R.C. Dubey, S Chand publications
2. Biotechnology: Fundamentals and Applications by S. S. Purohit, 1 January 2005, Agrobios (India)
3. Industrial Microbiology- L. E. Casida- John Wiley &Sons
4. Industrial Microbiology- A. H. Patel, 1st edition 2008 MacMillan publication.
5. Food Microbiology-Frazier, W.C publication 1978.

ICT Backup:

1. https://www.encyclopedia.com/medicine/medical-magazines/biotechnology-ethical-issues
2. https://www.biologydiscussion.com/biotechnology/biotechnology-introduction-scope-andapplicationsof-biotechnology/11608
3. https://the-gist.org/2011/03/molecular-farming-%E2%80%93-how-plants-produce-thevaccines-oftomorrow/
4. https://embryo.asu.edu/pages/golden-rice
5. https://ejbpc.springeropen.com/articles/10.1186/s41938-018-0051-2
6. http://www.ijetsr.com/images/short_pdf/1512892504_300-306-chd967_ijetsr.pdf
7. https://www.fmi.org/docs/default-source/food-safety/biotechnologybackgrounder.pdf?sfvrsn=0

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23102MM	**MICROBIAL TECHNIQUES**	**Major Mandatory 2**	**2**

Course Objectives: To acquaint students with basic techniques in Microbial nutrition, Enumeration and Asepsis.

Learning Outcome: By the end of the course the student will be able to:

- To provide a basic understanding of the significance and methods of sterilization.
- To impart skill in handling and culture of Microorganisms.
- To reinforce the use of microscope and study the various types of stains and staining methods to be used for visualization of specimens.

Unit I **Microscopy and Stains**	Microscope- Simple and Compound: Principle. Parts, Functions and Applications. Stains and Staining Solutions- Definition of Dye and Chromogen. Structure of Dye and Chromophore. Functions of Mordant and Fixative. Natural and Synthetic Dyes. Simple Staining, Differential Staining and Acid Fast Staining with specific examples.	10 Hours
Unit II **Sterilization Techniques**	Sterilization and Disinfection Types and Applications: Dry Heat, Moist Heat, 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 Characteristics of Ideal Disinfectants and its evaluation	10 Hours

Unit III **Nutrition, Cultivation and** **Enumeration of Microorganisms**	Nutrition and Cultivation of Microorganisms: Nutritional Requirements and Classification of Different Nutritional Types of Organisms. Design and Types of Culture Media Concept of Isolation and its Method Growth and Enumeration: Growth kinetics and Growth Yield, Measurement of Growth & Enumeration of microorganisms.	10 Hours

Learner's space:

Development of own microscope using lenses, project on isolation of microorganisms from various sources. Chromatic and achromatic aberrations, Dark Field and Phase Contrast Microscope. Collecting information on Continuous and synchronous growth.

Reference Books:

1. Fundamental Principles of Bacteriology - A. J. Salle McGraw Hill
2. Microbiology–6th Edition (2006), Pelczar M.J., Chan E.C.S., Krieg N.R., The McGraw Hill Companies Inc. NY
3. Fundamentals of Microbiology by Frobisher, Thomson Learning; 9th edition
4. Prescott's Microbiology, 8thedition (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M, Sherwood, Christopher J Woolverton, Chris Woolverton, McGraw Hill Science Engineering, USA.
5. General Principles of Microbiology-Stanier 5th edition.

ICT Backup:

1. https://www.britannica.com/technology/microscope
2. https://nios.ac.in/media/documents/dmlt/Microbiology/Lesson-02.pdf
3. https://nios.ac.in/media/documents/dmlt/Microbiology/Lesson-04.pdf
4. https://nios.ac.in/media/documents/dmlt/Microbiology/Lesson-03.pdf
5. https://www.uwyo.edu/virtual_edge/lab05/nutritional.htm
6. https://www.uwyo.edu/virtual_edge/lab05/enumeration.htm

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23103MM	**PRACTICAL PAPER 1** (Practical of BT23101MM + BT23102MM)	**Major Mandatory 3**	**2**

1. Assignment- Study of any branch of biotechnology and its applications.
2. Isolation of organisms causing Food Spoilage.
3. Microscopic determination of Microbial flora from Yoghurt and Lactic Acid Bacteria Determination.
4. Determination of Alcohol content.
5. Components and working of Simple and Compound Microscope.
6. Sterilization of Laboratory Glassware and Media using Autoclave.
7. Preparation of Media- Nutrient broth and Agar, MacConkey Agar, Sabourauds Agar.
8. Isolation of Organisms: T-streak, Polygon method.
9. Enumeration of microorganisms by Serial Dilution, Pour Plate, Spread Plate Method.
10. Colony Characteristics of Microorganisms.

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23104MN	**MOLECULAR BIOLOGY**	**Minor**	**2**

Course Objectives: To acquaint students with DNA replication, recombination, mutation and repair & Tools in Genetic Engineering.

Learning Outcome: By the end of the course the student will be able to:

- Learn the molecular details of DNA replication.
- Understand the reasons for DNA mutations and mechanism of DNA repair & recombination.
- Understand concepts of cloning vectors & enzymes used in genetic engineering.

Unit I **Replication**	DNA Replication in Prokaryotes and Eukaryotes: Semi-conservative DNA replication DNA Polymerases and its role E. coli Chromosome Replication, Bidirectional Replication of Circular DNA molecules. Rolling Circle Replication, DNA Replication in Eukaryotes	10 Hours
Unit II **Mutation and DNA Repair**	Definition and Types of Mutations. Mutagenesis and Mutagens. (Examples of Physical, Chemical and Biological Mutagens) Types of Point Mutations, DNA repair Photo reversal, Base Excision Repair, Nucleotide Excision Repair, Mismatch Repair, SOS Repair and Recombination Repair.	10 Hours
Unit III **Introduction to Genetic Engineering**	Basics of Genetic Engineering (Recombinant DNA Technology) History of Genetic Material. Molecular Cloning and Cloning Vectors-Plasmids, Cosmids and Lambda bacteriophage Enzymes- DNA Polymerases, Restriction Endonucleases and its types, Ligases, Reverse transcriptases, Nucleases, Terminal Transferases, Phosphatases & Kinases, Topoisomerases.	10 Hours

Learner's space: Preparing working model of replication, project on effect of mutagens. DNA recombination and Holliday Model of recombination, Evolution in Enzymology: KLenow Polymerases, Taq DNA polymerases, T7 DNA polymerases.

Reference Books:

1. iGenetics, A Molecular Approach-3rd edition, Peter J. Russell
2. Biotechnology: Fundamentals and Applications, S.S. Purohit-4th edition, Agrobios (India) 2005.
3. Biotechnology, B. D. Singh, G. G. Publication, 2003
4. Genetic Engineering: Principles and Practice, Sandhya Mitra (Author)

ICT Backup:

1. https://www.youtube.com/watch?v=TNKWgcFPHqw
2. https://www.youtube.com/watch?v=mCaFgwWH61o
3. https://www.youtube.com/watch?v=KSlmkkN5ipE
4. https://www.khanacademy.org/test-prep/mcat/biomolecules/genetic-mutations/v/thedifferent-types-ofmutations
5. https://www.khanacademy.org/test-prep/mcat/biomolecules/genetic-mutations/v/thecauses-of-geneticmutations
6. https://www.khanacademy.org/test-prep/mcat/biomolecules/geneticmutations/v/mutagens-andcarcinogens
7. https://www.news-medical.net/life-sciences/Mechanisms-of-DNA-Repair.aspx
8. https://www.khanacademy.org/science/biology/biotech-dna-technology/dna-cloningtutorial/a/restrictionenzymes-dna-ligase.
9. https://www.yourgenome.org/facts/what-is-genetic-engineering 10. https://microbenotes.com/cloning-vect

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23105OE	**BIODIVERSITY AND CELL BIOLOGY**	**Open Elective 1**	**2**

Course Objectives: To acquaint students with concept of diversity in Biology, particularly in relation to plant, animal, and microbial diversity & to introduce the various types of experimental models used in Biological Sciences.

Learning Outcome: By the end of the course the student will be able to understand:

- The process of origin of life and concept of diversity in biology.
- The basic structure and functions of prokaryotic cells.
- The ultrastructure and functions of sub cellular organelles of eukaryotic cells and cell cycle.
- Some popularly used model organisms and their role in understanding biological processes.

Unit I **Ultrastructure of Prokaryotic cell**	Ultrastructure of Prokaryotic Cell: Concept of 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.	10 Hours
Unit II **Ultrastructure of Eukaryotic cell**	Ultrastructure of Eukaryotic Cell: Cilia and Flagella. Plasma membrane, Cytoskeletal filaments, Endoplasmic Reticulum, Ribosomes, Golgi Apparatus Lysosome, Mitochondria, Chloroplasts Nucleus, Comparison of Prokaryotic and Eukaryotic Cells	10 Hours
Unit III **Biodiversity and its conservation**	Concept of Biodiversity Introduction to Microbial Diversity: Habitats, Examples and Applications of Archaebacteria, Eubacteria, Blue-green Algae, Actinomycetes, Eumycota. Overview of Plant and Animal diversity Biotechnology in Biodiversity conservation-Gene banks & its types-Seed banks, pollen banks, DNA banks, Cryobiology	10 Hours

Learner's space:

Field visits to understand biodiversity, collaboration with NGOs or enthusiastic naturalists groups, contribution of different model organisms in research, origin of life, Study of Experimental model organism-*Escherichia coli, Arabidopsis thaliana, Drosophila melanogaster and Mus musculus.*

Reference Books:

1. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology by P.S.Verma & V.K.Agrawal (2005), S. Chand & Company Ltd
2. Microbiology–6th Edition (2006), Pelczar M.J., Chan E.C.S., Krieg N.R., The McGrawHill Companies Inc. NY
3. Prescott, Harley, and Klein's Microbiology-7th edition, McGraw Hill
4. iGenetics, A Molecular Approach -3rd edition, Peter J. Russel

ICT Backup:

1. https://youtu.be/STy21PvUvuc
2. https://youtu.be/VTo1GEpg5Z0
3. https://youtu.be/URUJD5NEXC8
4. https://www.khanacademy.org/science/ap-biology/natural-selection/origins-of-life-onearth/v/origins-of-life
5. https://ncert.nic.in/textbook/pdf/lebo115.pdf
6. https://onlinelibrary.wiley.com/doi/full/10.1038/npg.els.0000814

COURSE CODE	TITLE	CATEGORY	CREDITS
MS23104OE	**GENERAL MANAGEMENT- I**	**Open Elective 2**	**2**

Course Objectives: To make the students aware about Management philosophy towards business, customers and employees.

Learning Outcome: By the end of the course the student will be able to understand:

- To understand the basics of management.
- To study functions of management.
- To apply the management principles in his / her real life
- To plan and organise different activities and events

Unit I **Introduction to Management**	Management: Concept, Significance, Role & Skills, Levels of Management, Managerial Grid. Evolution of Management thoughts, Contribution of F.W Taylor, Henri Fayol and Contingency Approach Case Study	10 Hours
Unit II **Functions & Principles of Management**	Functions of Management MBO & MBE Planning & Organizing Depart mentation, Span of Control, Delegation	10 Hours
Unit III **Introduction to Leadership, Motivation & Coordination**	Meaning, Characteristics, Styles and Qualities of Good Leader, Ways to develop leadership skill Directing: Meaning and Process Co-ordination as an Essence of Management Biography of some great leaders form India & out of India as well Team Building	10 Hours

Learner space: Case studies can be given to students which will give them insight of topics. Assignment and group projects can be done by students to get real knowledge of projects. Practical calculations in questions will bring clear understanding about funds estimation of projects.

References Books:

1. The Practice of Management by Peter F. Drucker.
2. Management: Tasks, Responsibilities and Practices by Peter. F. Drucker.
3. People and Performance by Peter F. Drucker.
4. Management: Global Edition by Stephen P. Robbins and Mary A. Coulter.

ICT Backup:-

1. https://www.yumpu.com/en/document/read/32322657/35-globalization-and-principles-of-management
2. https://open.lib.umn.edu/principlesmanagement/chapter/3-6-globalization-and-principles-of-management/
3. http://edunepal.info/bbsnotes/bbs-1st-year-pom-notes.html
4. https://www.youtube.com/watch?v=gHnsLB8MSGA
5. powerpoint presentations

Pedagogy: Faculties often use cases, simulations, and projects to achieve learning objectives in the Principles of Management Subject. Many topics such as functions & principles can be taught through role-play method.

Guest Hours can be organized wherein eminent professionals from the industry can share their experiences and enable the aspiring students to broaden their vision.

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23107VS	**BIOMOLECULES**	**Vocational Skill Course**	**2**

Course Objectives: To acquaint students with Bioorganic Molecules.

Learning Outcomes: By the end of the course the student will be able to:

- Describe the Classification, Structure and Functions of various Carbohydrates & Lipids.
- Understand Amino acids & their role, Protein structure and conformation.
- Understand the Structure, Properties, Types and importance of nucleic acids.

Unit I **Biomolecules: Carbohydrates and Lipids**	**Carbohydrates:** General functions of Carbohydrates Nomenclature: Classification based on simple sugars (mono, oligo, poly) Classification based on carbonyl function (aldose, ketose) Structure, Physical and Chemical properties of Monosaccharides Complex Carbohydrates: Structure and Types of Oligosaccharides and Polysaccharides **Lipids:** General functions of Lipids, Classification of Lipids Structure and Characteristics of Fatty acids Structure and Functions: Triacylglycerol, Phospholipids, Glycolipids and Lipoproteins Steroids: Structure and Function of Cholesterol Amphipathic lipids	10 Hours

Unit II **Biomolecules:** **Proteins and Amino Acids**	Amino acids: Properties, Structure, Function and classification Chemical tests, Ionization and Titration Curve of Amino Acids. Concept of Isoelectric pH, Zwitter ion. Proteins: Classification based on Structure and Functions. Denaturation of protein.	10 Hours
Unit III **Biomolecules:** **Nucleic Acids**	Structure of Nitrogenous Bases, Nucleosides, Nucleotides, Polynucleotides. Hydrogen Bonding between Nitrogenous Bases in DNA. Properties, Types and Functions of DNA and RNA. Differences between DNA and RNA.	10 Hours

Learner's space: Extraction of biomolecules of industrial significance from natural sources. Stereoisomers of monosaccharides, Chemical Reactions for Detection of Mono. Di and Polysaccharides

Reference Books:

1. Lehninger, Principles of Biochemistry. 5th Edition (2008), David Nelson & Michael Cox, W.H. Freeman and company, NY.
2. Biochemistry by U. Satynarayana and U. Chakrapani. 3rd edition.
3. Outlines of Biochemistry: 5th Edition, (2009), Erice Conn & Paul Stumpf; John Wiley and Sons, USA

ICT Backup:

1. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000002BI/P000991/M016859/ET/1467781230Module17.pdf
2. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000002BI/P000991/M016863/ET/1467781981module21Phospholipids.pdf
3. https://microbenotes.com/carbohydrates-structure-properties-classification-and-functions/ https://www.khanacademy.org/science/biology/macromolecules/proteins-andaminoacids/a/introduction-to-proteins-and-amino-acids
4. https://www.khanacademy.org/science/biology/macromolecules/proteins-and-aminoacids/a/orders-ofprotein-structure
5. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000002BI/P000991/M020196/ET/1495017622Module-2-Etext.pdf

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23108SE	**PRACTICAL PAPER 2** (Practical of BT23104MN+BT23105OE+ BT23107VS)	**Skill Enhancement Course**	**2**

1. Staining of Plant and Animal Tissues.
2. Special Staining Technique for Cell Wall, Capsule and Endospores and Fungal Staining.
3. Monochrome Staining
4. Gram Staining
5. Acid fast Staining and Romanowsky staining.
6. Study of Photomicrographs of Cell Organelles.
7. Spot test for Carbohydrates, Fats and Proteins and Amino Acids and Nucleic Acids.
8. Standardization of Colorimeter
9. Estimation of reducing sugar by DNSA method.
10. Estimation of protein by Lowry method.
11. Extraction of Genomic DNA from onion.

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23109AE	**Foundation Course**	**Ability Enhancement Course**	**2**

Course Objectives:

1. To acquaint students with multi- cultural diversity of Indian society.
2. To understand the concept of disparity as arising out of stratification and inequality.
3. To analyze the inequalities and its manifestation in inter- group conflicts.
4. To understand the philosophy and basic features of the Indian Constitution.
5. To develop students' abilities to think role of youth in promoting tolerance, peace and communal harmony.
6. To acquaint the student with the basic understanding of various growing social problems in India.
7. To make students aware of the origin and evolution of the concept of Human Rights

8.To make students understand the importance of the concepts of ecology and environmental and its impact on human life.

Learning Outcomes: At the end of the course, the student will be able to:

1. Learners will acquire a deeper and more inclusive understanding of Indian society, its nature, social problems, role of Indian Constitution and youth in maintaining the social fabric of Indian society.
2. They will know the concept of disparity as arising out of social stratification and inequality
3. They will understand evolution and Salient features of the Indian Constitution
4. Learners will acquire a deeper and more inclusive understanding of the origin and evolution of Human Rights.
5. An awareness about the environmental problems will be created along with the introduction of the concept of sustainable development.
6. The course will enable students to understand the different stressors in their life as well as it will equip them with some techniques of coping and management of stress and conflicts.

Unit I **Overview of Values in Indian Society**	Multi-cultural nature of Indian society The linguistic diversity in India Regional variations in the context of rural, urban and tribal demography The unity in diversity	10 Hours

Unit II **Disparity and Altruism**	Problems of equality to Disable and Welfare Schemes for Disables The inequalities manifested due to the caste system. Inter-group conflicts arising out of communalism Role of Youth for peace and harmony in strengthening the social fabric of Indian society	10 Hours
Unit III **Values in Indian Constitution**	Evolution of the Indian Constitution Philosophy of the Constitution as set out in the Preamble Salient features of the Indian Constitution Fundamental Duties of the Indian Citizens	10 Hours

Learners Space

In addition to the assigned curriculum, there will be innovative ways for students with a special interest in social, economic, constitutional or political aspects. The subject foundation course is very wide and its scope is enlarged. The students can do various things along-with the prescribed things in curriculum. In addition to the syllabus presented, they will be informed about various references.to develop this attitude the use of following things are recommended.

1. Watch a television programme based on subject matter of foundation course and mark out its different perspectives
2. Prepare a survey based report on the primary sources available in your village or town and throw light on social and economic challenges faced by the people.
3. Work with NGO or any serving organization to help challenged and destitute section in the society.

Reference Books:

1. Asthana, D. K., and Asthana, Meera, *Environmental Problems and Solutions*, S. Chand, New Delhi, 2012.
2. Bakshi, P.M., *Indian Constitution*,
3. Baron, R. A., & Kalsher, M. J. (2008). Psychology: From Science to Practice.(2nd ed) Pearso n Education inc., Allyn and Bacon Basu, D.D., *An Introduction to the Indian Constitution*,
4. Lahey, B. B. (2007). Psychology: An Introduction. (9th ed.). McGraw- Hill Publications, Ne w York
5. Mohapatra, Gaur Krishna Das, *Environmental Ecology*, Vikas, Noida, 2008.
6. Motilal, Shashi, and Nanda, Bijoy Lakshmi, *Human Rights: Gender and Environment*, Allied Publishers, New Delhi, 2007.
7. Sharma, P.D., *Ecology and Environment*, Rastogi Publications, 2015.
8. Shiva, Vandana *Ecology and the Politics of Survival: Conflict over Natural Resources in Indi*a, Sage Publications, California, 1991.

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23110VE	**COMMUNICATION SKILLS**	**Value Education Course**	**2**

Course Objectives: To prepare the students to interact effectively with researchers, scientists and other personnel.

Learning Outcomes: At the end of the course, the student will be able to:

- Describe the fundamentals and barriers to communication.
- Outline the types of communication.
- Apply the writing skills in job applications, letters, resume.
- Elaborate on the process of scientific writing.

Unit I **Basic concepts of Communication**	Concepts, Definitions, Scope of Communication Fundamentals of Communication (7 C's) Guidelines of Effective Communication Barriers to Communication Communication as a part of Science	10 Hours
Unit II **Communication Elements**	Types of Communication - Verbal Communication, Nonverbal Communication, Listening Communication, Written Communication & Visual Communication Oral Presentations Writing Skills: Job Applications, Letters, Resume, E-Mail Application, SOP	10 Hours
Unit III Scientific Writing	Process of Scientific Writing: Thinking, Planning, Rough Drafts and Revising Contents Introduction to Scientific Reports and Writings Compilation of Experimental Data, Communication methods in Science, Examples of Scientific and Unscientific Writing. Writing papers, Reviews, Bibliography Plagiarism – Introduction to Plagiarism, Examples of Plagiarism	10 Hours

Learner's space: Learn Data Collection Methods and Practice Research Paper and Article Writing.

Reference books:

1. Communication skills in English, Dr. Neeta Chakravarty, Manan Prakashan
2. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd edition, Pearson education, 2011
3. Communication Skills, Sanjay Kumar, Pushpalatha, 1st edition, Oxford Press, 2011

ICT backup:

1. https://www.skillsyouneed.com/ips/communication-skills.html
2. https://aplmed.com/my-account/manager-training-2/16-hours-class/6-effectivecommunication/communication-techniques-and-guidelines/
3. https://byjus.com/commerce/types-of-communication/
4. https://www.skillsyouneed.com/writing-skills.html
5. https://www.scribbr.com/category/plagiarism/
6. https://www.scribbr.com/category/plagiarism/

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23111IK	**GLORIOUS SCIENTIFIC TRADITIONS OF INDIA**	**Indian Knowledge System**	**2**

Course Objectives: To acquaint students with the basic knowledge about the development of science and technology in India.

Learning Outcome: By the end of the course the student will be able to:

- Describe the development of science in India.
- Recognize the various scientific fields in which Indians have made their contributions.
- Draw linkages between modern Indian science and its rich scientific heritage.

Unit I **Science and Technology-The Beginning**	Development in different branches of Science in Ancient India: Astronomy, Mathematics, Engineering and Medicine. Developments in metallurgy: Use of Copper, Bronze and Iron in Ancient India.	10 Hours
Unit II **Science and Technology in Medieval and Colonial India**	Developments in the fields of Mathematics, Chemistry, Astronomy and Medicine. Innovations in the field of agriculture - new crops introduced new techniques of irrigation etc. Indian Response to new Scientific Knowledge, Science and Technology in Modern India. Development of research organizations like CSIR and DRDO; Establishment of Atomic Energy Commission; Launching of the space satellites	10 Hours
Unit III **Prominent scientist of India since beginning and their achievement**	Mathematics and Astronomy: Baudhayan, Aryabhtatta, Brahmgupta, Bhaskaracharya, Varahamihira, Nagarjuna. Medical Science of Ancient India (Ayurveda & Yoga): Susruta, Charak, Yoga & Patanjali. Scientists of Modern India: Srinivas Ramanujan, C.V. Raman, Jagdish Chandra Bose, Homi Jehangir Bhabha and Dr. Vikram Sarabhai.	10 Hours

Reference books:

1. India's Glorious Scientific tradition, Suresh Soni Prabhat Prakashan-Delhi
2. History of Science and Technology in India, Dr. Binod Bihari Satpathy
3. Indian Science and Technology in the eighteenth century, Dharampal, Impex India, July 1971.

SEMESTER II

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23201MM	PHYSIOLOGY & ECOLOGY	Major Mandatory 1	2

Course Objectives: To acquaint students with physiological processes in plants and animals and knowledge of ecosystem.

Learning Outcome: By the end of the course the student will be able to:

- Understand the chemical basis of photosynthesis and mechanism of light reactions.
- Understand the physiology of various systems in animals.
- Understand functioning of ecosystem and interactions.

Unit I **Plant Physiology**	Photosynthesis, Intracellular Organization of Photosynthetic System. Fundamental Reactions of Photosynthesis Photosynthetic Pigments, Role of Light, Hill Reaction and its Significance. Light Reactions, Cyclic and Non-Cyclic Photo Induced Electron Flow, Energetics of Photosynthesis, Photorespiration.	10 Hours
Unit II **Animal Physiology**	Physiology of Digestion: Movement of Food and Absorption, Secretary functions of Alimentary Canal, Digestion and Absorption, assimilation in Gut of Mammals Physiology of Respiration: Mechanism of Respiration, Principles of Gaseous Exchange in the Blood and Body Fluids Physiology of Circulation: Blood Composition, Structure and Function of its Constituents Regulation of the Circulation Mechanism and working of Heart in Human. Physiology of Excretion: Anatomy of Mammalian Kidney, Structure of Nephron, Urine Formation and Role of Kidney in Excretion and Osmoregulation	10 Hours

Unit III **Ecosystem and Interactions**	Ecosystems, Components, Structure and Function of Ecosystems, Trophic Levels, Food Chain and Food Web, Ecological Pyramids (Energy, Biomass and Number) Ecological interactions: Interactions, Commensalism, Mutualism, Predation and Antibiosis, Parasitism.	10 Hours

Learner's space:

Preparing working model of plant and animal physiology processes, reading and collecting science articles on environment. Mechanism of water absorption.

Reference Books:

1. A Textbook of Plant Physiology- Verma V., Ane Books India, 4th edition, 2007
2. Plant physiology - Zeiger, E., Taiz L., United Kingdom: Sinauer Associates. 2010.
3. Plant Biotechnology- K. G. Ramavat S.Chand Publications
4. Devlin R.M. (1983) - Fundamentals of Plant Physiology (Mac. Millan, New York)
5. Applegate anatomy and physiology Learning systems – Guyton
6. Human anatomy and Physiology by Marieb,6th edition
7. Cell biology, Genetics, Molecular biology, Evolution and Ecology by Verma and Agarwal,2005

ICT Backup:

1. https://www.britannica.com/science/photosynthesis
2. https://untamedscience.com/biology/plants/plant-growth-hormones/
3. https://www.britannica.com/science/human-digestive-system
4. https://www.youtube.com/watch?v=QsSdAXv5BEM&t=7s
5. https://www.youtube.com/watch?v=PlNEabFZ5Qk
6. https://www.youtube.com/watch?v=_qmNCJxpsr0&t=17s
7. http://ncert.nic.in/ncerts/l/lebo114.pdf
8. https://www.youtube.com/watch?v=nqPhY1-4f_0

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23202MM	**ENZYMOLOGY, IMMUNOLOGY & BIOSTATISTICS**	**Major Mandatory 2**	**2**

Course Objectives: To acquaint students with concepts in Enzymology, Immunology and Biostatistics.

Learning Outcome: By the end of the course the student will be able to:

- Classify enzymes and understand the kinetics of enzyme catalyzed reactions
- Differentiate between innate and acquired immunity, understand the different functional units of immunity in the body.
- Apply statistical tools in data analysis.

Unit I **Enzymology**	Definition, Classification, Nomenclature, Chemical Nature, Properties of Enzymes, Mechanism of Enzyme Action, Active Sites. Enzyme Specificity, Effect of pH, Temperature, Substrate Concentration on Enzyme Activity, Enzyme Kinetics, Michaelis-Menten Equation, Lineweaver Burk plot Types of Enzyme Inhibitions-Competitive, Uncompetitive, Non-Competitive Allosteric Modulators Co-Factors, Zymogens. Industrial applications of enzymes	10 Hours
Unit II **Immunology**	Overview of Immune Systems: Cell and Organs involved in immunity: T and B cells. Innate Immunity, Acquired Immunity, Local and Herd Immunity, Humoral and Cellular Immunity Antigens and Antibodies: Types of Antigens, General Properties of Antigens, Haptens and Superantigens. Discovery and Structure of Antibodies: (Framework region) Classes of Immunoglobulins, Antigenic Determinants. Antigen-Antibody Interactions.	10 Hours

Unit III **Biostatistics**	Definition, Importance & applications of Statistics in Biology Types of Data, Normal and Frequency Distribution Representation of Data and Graphs: Bar Diagrams, Pie Charts and Histogram, Polygon and Curve. Measures of Central Tendency: (For Raw, Ungroup & Group Data), Mean, Median, Mode. Measures of Dispersion Range, Variance, Coefficient of Variance. Standard Derivation. Standard Error.	10 Hours

Learner's space: Extraction of enzymes for industrial use, Data collection and analysis by statistical approach, learning computer software for statistical analysis.

Reference Books:

1. Outlines of Biochemistry: 5thEdition, (2009), Erice Conn & Paul Stumpf; John Wiley and Sons, USA
2. Lehninger, Principles of Biochemistry. 5thEdition (2008), David Nelson & Michael Cox, W.H. Freeman and company, NY
3. Kuby immunology, Judy Owen, Jenni Punt, SharonStranford.,7th edition (2002) edition (2012), Freeman and Co., NY
4. Introduction to Immunology- C. V Rao- Narosa Publishing House
5. Methods in Biostatistics- B. K. Mahajan –Jaypee Brothers
6. Biochemistry - U Satyanarayana, 4th edition (2004). Elsevier Health Sciences. 7. Biostatistics- PN Arora & PK Malhan, (2010) Himalaya Publishing House

ICT Backup:

1. https://www.britannica.com/science/enzyme
2. https://youtu.be/gtst3GZ7kjw
3. https://teachmephysiology.com/biochemistry/molecules-and-signalling/enzyme-inhibition/
4. https://www.britannica.com/science/antigen
5. https://youtu.be/8PWF5OeB7Ec
6. https://youtu.be/PzunOgYHeyg
7. https://youtu.be/9r0xzlpNjTw
8. https://www.dentalcare.com/en-us/professional-education/ce-courses/ce1/five-classessubclasses-ofimmunoglobulins 9. https://youtu.be/I64HjpsLnZg

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23203MM	**Practical Paper 1** (Practical of BT23201MM + BT23202MM)	**Major Mandatory 3**	**2**

1. Study of Hill's reaction.
2. Colorimetric study of Absorption Spectrum of Photosynthetic Pigments.
3. Analysis of Urine.
4. Study of Mammalian Blood, Blood count using Haemocytometer.
5. Estimation of Haemoglobin in Mammalian Blood.
6. Study of Human Blood Groups.
7. Study of Interactions- Commensalism, Mutualism, Predation and Antibiosis, Parasitism.
8. Enzyme Kinetics: Study of the effect of pH, Temperature, inhibitor on activity of Enzyme
9. Study of Effect of Substrate Concentration on enzyme activity and determination of Vmax and Km.
10. Study of antigen antibody interaction by Ouchterlony method.
11. Biometric Analysis for Mean, Median, Mode and Standard Deviation.
12. Data representation using frequency Polygon, Histogram and Pie Diagram.

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23204MN	**GENETICS**	**Minor 1**	**2**

Course Objectives: To acquaint students with concepts in Genetics.

Learning Outcome: By the end of the course the student will be able to:

- Understand fundamentals of Mendelian genetics.
- Understand methods of gene exchange in bacteria.
- Understand the concepts of Population Genetics.

Unit I **Genetics Fundamentals**	Mendel's Laws of Heredity - Monohybrid Cross: Principle of Dominance and Segregation. Dihybrid Cross: Principle of Independent Assortment. Allelic Interactions: Incomplete Dominance, Codominance, Multiple Alleles, Lethal alleles, Penetrance and expressivity.	10 Hours
Unit II **Microbial Genetics**	Genetic analysis in Bacteria- Prototrophs, Auxotrophs. Bacteriophages: Lytic and Lysogenic cycle Mechanism of Genetic Exchange in Bacteria: Conjugation; Transformation; Transduction; (Generalized Transduction, Specialized Transduction) Bacterial Transposable Elements.	10 Hours
Unit III **Population Genetics**	Introduction to basics of population genetics & terminologies. Genetic Structure of Populations: Genotype Frequencies & Allele Frequencies The Hardy–Weinberg Law: Assumptions, mathematical expression, problems. Effects of Evolutionary Forces on the Genetic Structure of a Population: Mutation, Migration, Natural selection, Genetic drift & Speciation. Role of Population Genetics in Conservation Biology	10 Hours

Learner's space:

Data collection of human traits and its inheritance pattern, reading advance reference books and research papers. Gene Interaction: Epistasis, Genetic Variation in Natural Populations: Measuring

Genetic Variation at the Protein Level & Measuring Genetic Variation at the DNA Level

Reference Books:

1. iGenetics- Mendelian approach by Peter Russell
2. Microbiology by Pelczar (5th edition)
3. Genetics-Mendelian approach by Peter Russell (5th edition)

ICT Backup:

1. https://www.khanacademy.org/science/high-school-biology/hs-classical-genetics/hsintroduction-toheredity/a/hs-introduction-to-heredity-review
2. https://youtu.be/3CQqFpKiRhw
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1392256/
4. https://www.khanacademy.org/science/ap-biology/gene-expression-andregulation/mutationsap/a/genetic-variation-in-prokaryotes#:~:text=In%20transformation%2C%20a%20bacterium%20takes,through%20a%20tube%20between%20cells.
5. https://biologydictionary.net/lytic-cycle/
6. https://www.khanacademy.org/science/ap-biology/natural-selection/hardyweinbergequilibrium/v/hardy-weinberg

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23205OE	**BASIC CHEMISTRY**	**Open Elective 1**	**2**

Course Objective: To acquaint the students with basic concepts of Chemistry.

Learning Outcome: By the end of the course the student will be able to:

- Classify and name inorganic and organic compounds based on IUPAC system.
- Understand concepts on various chemical bonds & their role in biological compounds.
- Learn the role of water in biology & preparation of buffers of different pH.

Unit I **Chemical Bonds & Isomerism**	**Chemical Bonds:** Ionic Bond, Covalent Bond, Nature of Coordinate Bond, Van Der Waals forces, Hydrogen Bond its types. **Isomerism**: Types of Isomerism: Constitutional Isomerism (Chain, Position and Functional) and Stereoisomerism, Chirality. **Geometric Isomerism and Optical Isomerism:** Enantiomers, Diastereomers, and Racemic mixtures Cis-Trans, Threo, Erythro and Meso isomers.	10 Hours
Unit II **Analytical Chemistry & Techniques**	**Titrimetric Analysis:** Basic concepts and Types of Titration **Gravimetric Analysis:** Solubility and Precipitation, Co-Precipitation and PostPrecipitation, Nucleation, Particle Size, Crystal and Colloidal State, Ageing/Digestion of Precipitate. Washing, Drying and Ignition of Precipitate. **Chromatography:** Introduction, Principle, Types (Paper Chromatography, Thin layer Chromatography and Column Chromatography) and Applications. **Colorimetry:** Principle, Beer-Lamberts Law- Derivation, Measurements and Limitations	10 Hours

Unit III **Water and Buffers**	**Chemistry of Water:** Properties, Role of Water in Biomolecular Structure and as a Medium for Life. **Solutions:** Normality, Molarity, Molality, Mole fraction, Mole concept, Solubility, Weight ratio, Volume ratio, Weight to Volume ratio, ppb, ppm, millimoles, milliequivalents (Numericals expected). **Acids and Bases:** Lowry-Bronsted and Lewis Concepts. Strong and Weak Acids and Bases - Ionic Product of Water - pH, pKa, pKb. **Buffer solutions:** Concept of Buffers, Types of Buffers, Derivation of Henderson equation for Acidic and Basic buffers. (Numericals expected.)	10 Hours

Learner's space: To explore the relatedness of stereochemistry and analytical techniques in the biology field.

Reference Books:

1. University General Chemistry, 1st edition (2000), C.N. R. Rao
2. Physical Chemistry University for biological sciences,1stedition, Chang R.
3. Essentials of Physical Chemistry, 24th edition, (2000), B S Bahl, G D Tuli, Arun Bahl.
4. Concise Inorganic Chemistry .5th edition (2008), Author: J. D. Lee
5. Organic Chemistry, 6th edition, (1992), Morrison Robert Thornton
6. Fundamentals of Analytical chemistry, Skoog, West, Holler, Crouch
7. Vogels' TextBook of Quantitative Chemical Analysis, G H Jeffery, J Bassett, J Mendham, R C Denney
8. Analytical Biochemistry, 3 edition, (1998), David Holmes, H. Peck, Prentice Hall, UK.
9. Modern Analytical Chemistry, David Harvey
10. Principles and Practice of Analytical Chemistry Fifth Edition, F.W. Fifieldand D. Kealey

ICT Backup:

1. https://www.britannica.com/science/isomerism
2. https://www.toppr.com/guides/chemistry/coordination-compounds/geometric-and-opticalisomerism/
3. https://www.youtube.com/watch?v=_obE4YAVJS4
4. https://www.toppr.com/guides/chemistry/solutions/titration-types-examples-procedure/
5. https://paramedicsworld.com/biochemistry-practicals/demonstration-of-colorimeterprinciplecomponents-working-uses-applications/medical-paramedical-studynotes
6. https://amrita.olabs.edu.in/?brch=2&cnt=1&sim=96&sub=73 7. https://chemdictionary.org/chromatography/

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23207VS	**TISSUE CULTURE & DAIRY TECHNOLOGY**	**Vocational Skill Course**	**2**

Course Objectives: To acquaint students with Techniques of Plant and Animal Tissue Culture & Dairy microbiology.

Learning Outcome: By the end of the course the student will be able to:

- Understand the basic culturing techniques of animal cell culture.
- Understand aseptic techniques involved in plant tissue culturing and perform culturing under sterile conditions.
- Understand the concept of culturing and preservation techniques in dairy technology related to various dairy products.

Unit I **Plant Tissue Culture**	Concept of Totipotency, Organization of Plant Tissue Culture Laboratory, Equipments and Instruments Aseptic Techniques: Washing of Glassware, Media Sterilization, Aseptic Workstation, Precautions to maintain Aseptic Conditions. Culture Medium: Nutritional requirements of the explants, PGR's and their in-vitro roles Media Preparation Callus Culture Technique: Introduction, Principle and Protocols	10 Hours
Unit II **Animal Tissue Culture**	Basics of Animal Tissue Culture Introduction to Animal Tissue culture, Types of Cell Culture Techniques. Laboratory Organization and Layout for Animal Tissue Culture Laboratory, Equipment, Sterilization Methodology.	10 Hours

	Introduction to Animal Cell Culture media: Nutritional and Physiological factors, Growth Factors and Growth Parameters. Growth Kinetics, Establishment of primary cell culture Application of Cell Cultures	
Unit III **Dairy Technology**	Milk - Normal flora, changes in raw milk. Enumeration Factors affecting bacteriological quality, Preservation methods, Pasteurization, Starter cultures, Fermented products- Production process and spoilage of cheese: Swiss and Cheddar, Butter, Yoghurt and Buttermilk.	10 Hours

Learner's space:

Industry visits, literature survey-based project, experimental project on nutritional and microbiological quality of milk and milk products, Organogenesis, Somatic embryogenesis and synthetic seeds, Maintenance of Primary Cell Culture.

Reference Books:

1. Plant Biotechnology- K. G. Ramavat S.Chand Publications
2. Plant Tissue Culture by Kalyan Kumar De
3. Experiments in Plant tissue culture- Dodds and Roberts- Cambridge University Press
4. Culture of Animal cells- Ian Freshney -- John Wiley &Sons
5. Principles and Practice of Animal Tissue culture- Sudha Gangal–University Press
6. Applied Dairy Microbiology Elmer H Marth and James L Steele, Mercel Dekker Inc New York, 2nd edition
7. Microbial Technology Peppler, H.J and Perlman, D 2nd Academic Press Practicals
8. Industrial Microbiology Prescott and Dunn CBS publishers Dairy Technology by Yadav and Grower

ICT Backup:

1. https://phytotechlab.com/media/documents/TechnicalLiterature/ComponentsOfTissueCulture Media.pdf

2. https://www.biologydiscussion.com/plant-tissues/callus-culture/callus-culture-historyprinciples-andsignificance-plant-tissue-culture/14597#:~:text=If%20a%20bit%20of%20tissue,of%20medicinal%20plants%20in%20n ature.
3. https://www.biologydiscussion.com/plant-tissues/totipotency/totipotency-meaning-expressionandimportance-plant-tissue-culture/14641
4. https://www.intechopen.com/books/biomedical-tissue-culture/culture-conditions-and-types-ofgrowthmedia-for-mammalian-cells
5. https://www.biologydiscussion.com/biotechnology/animal-biotechnology/culture-media-foranimalcells-an-overview/10499
6. https://iopscience.iop.org/book/978-0-7503-1347-6/chapter/bk978-0-7503-1347-6ch1
7. https://www.biologydiscussion.com/industrial-microbiology-2/cheese/how-is-cheese-madestep-by-stepprinciples-production-and-process/86647
8. http://www.madehow.com/Volume-4/Yogurt.html
9. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=5303
10. http://ecoursesonline.iasri.res.in/mod/resource/view.php?id=5761

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23208SE	**PRACTICAL PAPER 2** (Practical of BT23204MN + BT23205OE+ BT23207VS)	**Skill Enhancement Course**	**2**

1. Problems in Mendelian Genetics.
2. Preparation of Standard (Molar, Molal and Normal solutions) and Buffer Solutions.
3. Determination of strength of HCl in commercial sample.
4. Determination of the amount of Fe (II) present in the given solution Titrimetrically.
5. Determination of the amount of Mg (II) present in the given solution complexometrically.
6. Determination of percent composition of $BaSO_4$ and NH_4Cl in the given mixture gravimetrically.
7. Working and use of various Instruments used in Biotechnology Laboratory (Autoclave, Hot air Oven, Centrifuge, Incubator, Rotary Shaker, Filter Assembly, LAF, pH meter and Colorimeter, CO_2 Incubator, Inverted Microscope)
8. Preparation of PTC Media, Aseptic Transfer Technique and Inoculation for Callus Culture.
9. Trypsinization of Animal Tissue and Viability Count.
10. Analysis of Milk- Methylene Blue, Resazurin Test, Phosphatase Test.
11. Estimation of milk protein by Pyne's method.

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23209AE	**BASIC COMPUTER KNOWLEDGE**	**Ability Enhancement Course**	**2**

Course Objectives: To acquaint students with basic concepts and skills of Microsoft office software like Microsoft Word, PowerPoint, Excel, etc.

Learning Outcome: At the end of the course the students will be able to:

- Describe the parts of computer, input and output devices.
- Elaborate on the steps involved in setting up PowerPoint presentation.
- Outline the data with the help of excel workbook.
- Enlist the applications of Microsoft word, excel and PowerPoint.

Unit I **Organization of Computer**	Computer Basics: Introduction to Computers, Types of Computers, Organization of a Computer; Input Devices, Output Devices, Central Processing Unit, Arithmetic Logical Unit Computer Memory: ROM, RAM Computer Processor; Operating System.	10 Hours
Unit II **Microsoft POWERPOINT**	Introduction and Basic Concept of Microsoft PowerPoint Working of MS PowerPoint: Setting Up PowerPoint Environment, Creating Slides and Applying Themes, Working with Bullets, Numbering and Objects; Movies, Sounds, Hyperlinks, Action Buttons, Using SmartArt, Tables, slide master, Animation and Slide Transition, Slide Show Option, Proofing and Printing Applications of PowerPoint	10 Hours
Unit III **Microsoft WORD & EXCEL**	Working of MS Excel and Word: Formatting excel workbook, Perform calculations with functions, sort and filter data with excel, Create effective charts to present data visually, analyze data using pivot tables and charts, protecting and sharing the work book, proofing And printing. Working with Objects, Header and Footers, Bullets, Numbered lists, Tables, Style, Content, Document Merging, Sharing and maintaining Documents, Proofing the document, Printing. Applications of MS Excel and Word.	10 Hours

Learner's Space: Learn to explore other Microsoft Applications and Biological Databases.

References:

1. Computer Basics by G. Manjunath by Vasan Publishers.
2. Fundamentals of Computer and Information Technology by R. S. Salaria by Khanna Publishers.
3. Computer Fundamentals 6th edition by Pradeep Sinha by BPB publishers.
4. Computer Fundamentals by Architecture & Organization Ram B. 4th ed New Age

ICT Backup:

1. https://mrcet.com/downloads/digital_notes/CSE/II%20Year/COMPUTER%20ORGANIZATION%20NOTES.pdf
2. https://theintactone.com/2019/10/12/cf-u1-topic-4-basic-computer-organization
3. https://www.vedantu.com/coding-for-kids/computer-memory
4. https://ecomputernotes.com/fundamental/introduction-to-computer/what-is-cpu
5. https://entri.app/blog/ms-power-point-notes/
6. https://www.geeksforgeeks.org/introduction-to-microsoft-word/
7. https://www.guru99.com/introduction-to-microsoft-excel.html

COURSE CODE	TITLE	CATEGORY	CREDITS
BT23210VE	**ENVIRONMENTAL SCIENCES**	**Value Education Course**	**2**

Course Objectives: To make the students aware about different types of environmental pollution and related issues.

Learning Outcomes: By the end of the course the student will be able:

- Explain the causes, types and control methods for environmental Pollution.
- Outline the different environmental Global issues.
- Describe the application and use of different life forms in environmental remediation.

Unit I **Environmental Pollution**	**Sources of Pollution Air** **Pollution:** Types, Sources, Classification of Air Pollutants, Air Pollution Monitoring and Control **Water Pollution:** Causes, Types and Classification, Eutrophication, Assessment of Water Quality- Pollutant Monitoring and Control **Soil and Solid Waste Pollution:** Characteristics of Wastes, Impacts of Solid waste on Health, Occupational Hazards and Control	10 Hours
Unit II **Global Environmental Problems and Issues**	**Green House Effect:** Factors Responsible for Green House Effect, Green House Gases, Global Warming, Ozone Depletion, Kyoto Protocol, UV Radiation, Acid Rain	10 Hours

Unit III Bioremediation	Concept of Bioremediation, Microorganisms in Bioremediation, Mycoremediation, Phytoremediation. Bioremediation Technologies. Measuring Bioremediation in the field. Bioaugmentation and Biostimulation. Monitoring the Efficacy of Bioremediation	10 Hours

Learner's space: Study Bioremediation and Biosorption with use of Consortium of Organisms.

References:

1. Environmental Biotechnology Allan Scragg, Oxford University Press
2. Environmental Biotechnology Indu Shekhar Thakur, IK International (Basic Concepts and Applications)
3. Environmental Biotechnology, M.H.Fulekar

ICT backup:

1. https://www.insightsonindia.com/environment/environment-pollution-and-control/environmentpollution-introduction-types-and-sources/
2. https://www.vedantu.com/biology/air-pollution-control
3. https://www.vedantu.com/biology/water-pollution-control
4. https://www.pmfias.com/soil-pollution-solid-wastes-hazardous-waste-electronic-waste-e-waste/
5. https://prepp.in/news/e-492-green-house-gases-environment-notes
6. https://www.investopedia.com/terms/k/kyoto.asp
7. https://www.onlinebiologynotes.com/bioremediation-concept-types-advantages-and-limitations/
8. https://soilhealth.ucdavis.edu/application/files/1215/4208/1811/Bioremediation_Biostimulation_and_Bi oaugmention_A_Review.pdf

Evaluation Pattern

1. **Core Courses:** The College will conduct all the semester examinations of 100 marks per Theory Paper in the prescribed pattern of 40 marks of internal assessment/Project work and 60 marks for semester end examination. **The student will have to secure a minimum of 40% marks in internal assessment as well as semester end examination per theory paper, for all the above theory papers.**
2. **For Courses of OE, AEC, VEC, IKS, CC**: The College will conduct all the semester examinations of 50 marks per Theory Paper in the prescribed pattern of 20 marks of internal assessment/Project work and 30 marks for semester end examination. **The student will have to secure a minimum of 40% marks in internal assessment as well as semester end examination per theory paper, for all the above theory papers.**
3. The College will conduct all the semester examinations of 100 marks per Practical Paper at the end of each semester. **The student will have to secure a minimum of 40% marks in the examination per practical paper, for all the above practical papers.**

Evaluation Pattern
For F.Y.B.Sc. Biotechnology (Theory: Core Courses)

1.	**INTERNAL ASSESSMENT**		**40 Marks**
1.1	One class test (Objectives/ Multiple Choice)		20Marks
1.2	Assignment/ Project/ Presentation/Book or Research paper Review		15Marks
1.3	Active Participation, Overall performance		05 Marks
2.	**EXTERNAL ASSESSMENT (Semester End Examination)**		**60 Marks**
	N.B. 1. All questions are compulsory 2. All questions carry equal marks.		
	Q.1.	Based on Unit-I, II & III Multiple choice questions/Fill in the blanks /Match the column/Give one word/Name the following/Give an example/Explain the term/Define	**12**
	Q.2.	Unit-I Long Answer Question Short Answer Question	**12** 12/08/06 04/02
	Q.3.	Unit-II Long Answer Question Short Answer Question	**12** 12/08/06 04/02
	Q.4.	Unit-III Long Answer Question Short Answer Question	**12** 12/08/06 04/02
	Q.5. a b c d e f	Short Notes based on Unit I, II and III (Solve any three out of six)	**12**

Evaluation Pattern

For F.Y.B.Sc. Biotechnology (Theory: Courses of OE, AEC, VEC, IKS, CC)

1.	**INTERNAL ASSESSMENT**		**20 Marks**
1.1 1.2	One class test (Objectives/ Multiple Choice) Assignment/ Project/ Presentation/Book or Research paper Review		10Marks 10Marks
2.	**EXTERNAL ASSESSMENT (Semester End Examination)**		**30 Marks**
	N.B. 1. All questions are compulsory 2. All questions carry equal marks.		
	Q.1.	Unit-I Long Answer Question Short Answer Question	**10** 05+05 OR 04+06 OR 04+04+02
	Q.2.	Unit-II Long Answer Question Short Answer Question	**10** 05+05 OR 04+06 OR 04+04+02
	Q.3.	Unit-III Long Answer Question Short Answer Question	**10** 05+05 OR 04+06 OR 04+04+02

Evaluation Pattern
F.Y.B.Sc Biotechnology (PRACTICAL)

1.	EXTERNAL ASSESSMENT	100 Marks
	Experiment –1(Major technique)	25
	Experiment –2 (Major technique)	25
	Experiment -3 (Minor technique)	15
	Experiment -4 (Minor technique)	15
	Viva	10
	Journal	10
	TOTAL MARKS	100