



Bharatiya Vidya Bhavan's

**M. M. College of Arts, N.M. Institute of Science,  
H.R.J. College of Commerce. (Bhavan's College)**

**Autonomous**

**(Affiliated to University of Mumbai)**



**Syllabus for: F.Y.B.Sc. Biotechnology under NEP**

**MAJOR:BIOTECHNOLOGY FOR HUMAN WELFARE AND MINOR IN  
MOLECULAR BIOLOGY AND GENOMIC**

**Program: B.Sc.**

**Program Code: BH.US**

**Course Code: (BH. USBT)**

**Choice Based Credit System (CBCS)  
with effect from academic year 2023-24**

## PROGRAM OUTCOMES

PO	PO Description A student completing Bachelor's Degree in Biotechnology program will be able to:
PO-1	Apply knowledge and experience to foster personal growth and better appreciation of the diverse scientific world.
PO-2	Communicate competently through writing, reading, speaking, and to be able to connect to the scientific community in a meaningful way
PO-3	Acquire knowledge in the field of Biotechnology, molecular biology and genomics and other allied courses
PO4	Develop a knowledge base sufficient to appear for various examinations and to choose the post graduate program in the field of biotechnology and related research programs.
PO5	To get trained, skilled human resource to establish the Industry and Research sectors.
PO6	The course empowers the students with conceptual and practical skills of biotechnology and introduces students with latest development in the field of Biotechnology
PO6	Anticipate the future needs of Biotechnology Sector with more emphasis on imparting <i>hands-on</i> skills which make them sensitive and sensible citizen.

## PROGRAM SPECIFIC OUTCOMES

	DESCRIPTION
	<b>A student completing the certificate course in biotechnology will be able to:</b>
PSO-1	Understand the basic principles of biotechnology and its application
PSO-2	Gain the knowledge of process of basic Molecular Biology and genetics and its application in biotechnology
PSO-3	Understand basic practical skills, use of microscope and other microbiology lab instruments and cultivation of Microorganism
PSO-4	Understand and to learn the history and use of Indian culture and role medicinal sciences and its significance
PSO-5	To gain the knowledge of quality control and Quality assurance, Bioethics and Intellectual property rights in Biotechnology
PSO-6	Understand importance of food biotechnology, fermentation and the skills of wine production
PSO-7	Understand the role of digital techniques in biotechnology through bioinformatics
PSO-8	Communicate and able to develop good scientific writing skill
PSO-9	Learn importance of nutrition for their wellness

**PROGRAM OUTLINE FOR FYBSC BIOTECHNOLOGY -LEVEL 4.5  
(CERTIFICATE COURSE)**

Subject type	COURSE CODE	COURSE TITLE	CREDITS
<b>SEMESTER I</b>			
Major	BH.USBT.MAJ101	Biotechnology I	3
Minor	BH.USBT.MIN101	Molecular Biology: Overview of Central dogma	3
Open elective	BH.USBT.OE101	Nutrition & Wellness	3
Vocational and Skill Enhancement (VSEC)	BH.USBT.VSEC101	Basic Lab Practices in Biotechnology	3
Indian knowledge system (IKS)	BH.USBT.IKS101	Ayurveda: The Root of Indian Medical Science	2
Ability enhancement (AEC)	BH.USBT.AEC101	Communication skill	2
Value added education (VEC)	BH.USBT.VEC101	QA-QC in Biotechnology	2
Practical -Major	BH.USBT.MAJ1P1	Biotechnology I	1
Practical -Minor	BH.USBT.MIN1P1	Molecular Biology: Overview of Central dogma	1
Practical -OE	BH.USBT.OE1P1	Nutrition & Wellness	1
Practical -VSEC	BH.USBT.VSEC1P1	Basic Lab Practices in Biotechnology	1
<b>SEMESTER II</b>			
Major	BH.USBT.MAJ201	Biotechnology II	3
Minor	BH.USBT.MIN201	Molecular Biology: Regulation of gene expression	3
Open elective	BH.USBT.OE201	IPR & Bioethics	3
Vocational and Skill Enhancement (SEC)	BH.USBT.VSEC201	Fermentation Technology: Wine production	3
Ability enhancement (AEC)	BH.USBT.AEC201	Scientific Communication	2
Value added education (VEC)	BH.USBT.VEC201	Bioinformatics	2
OJT/FP/CEP/CC	BH.USBT.CC201	Variable	2
Practical -Major	BH.USBT.MAJ2P1	Basic Biotechnology II	1
Practical -Minor	BH.USBT.MIN2P1	Molecular Biology: Regulation of gene expression	1
Practical -OE	BH.USBT.OE2P1	IPR & Bioethics	1
Practical -VSEC	BH.USBT.VSEC2P1	Lab Scale production of wine	1
	Total		44

## **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 are 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 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.

<b>Programme: B.Sc. Biotechnology</b>				<b>Semester: I</b>	
<b>Course: F.Y.B.Sc.: Biotechnology I (MAJOR)</b>				<b>Course Code: BH.USBT.MAJ101</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme (Theory)</b>	
<b>Lecture (Periods per week)</b>	<b>Practical (Periods per week per batch)</b>	<b>Tutorial( Periods per week per batch)</b>	<b>Credits (Theory +Practical )</b>	<b>Continuous Internal Assessment (CIA) (CIA-I &amp; II)</b>	<b>End Semester Examination (ESE)</b>
<b>3</b>	<b>1</b>	<b>NA</b>	<b>4</b>	<b>40</b>	<b>60</b>
<p><b>Course Objectives:</b> To familiarize the students in with concept of biodiversity and cell biology. To introduce students about the concept of various important biomolecules. Students will learn different fields on biotechnology and recent advances</p>					
<p><b>Course Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. Understand the detailed structure of prokaryotic cells with example.</li> <li>2. Students develops an understanding about functions, structure and reactions of various biomolecules like carbohydrates, proteins, lipids and nucleic acids.</li> <li>3. The students will be able to learn about the advances in biotechnology</li> </ol>					

<b>INDEX</b>		
<b>Units</b>	<b>Detailed descriptions</b>	<b>Lecture period /unit</b>
<b>UNIT I  Scope and Introduction to Biotechnology</b>	<ul style="list-style-type: none"> <li>• History &amp; Introduction to Biotechnology, what is Biotechnology? Traditional and Modern Biotechnology (4L)</li> <li>• Branches of Biotechnology: Plant Biotechnology, Animal Biotechnology, Marine Biotechnology, Agricultural Biotechnology, Industrial Biotechnology, Pharmaceutical Biotechnology and Environmental Biotechnology (7L)</li> <li>• Biotechnology Research in India. Biotechnology Institutions in India (Public and Private Sector) (2L)</li> <li>• Biotech success stories: COVID vaccine by Bharat Biotech, Cadila, Serum Institute and Bicon. (2L)</li> </ul>	15
<b>UNIT II  Biomolecules</b>	<ul style="list-style-type: none"> <li>• NUCLEIC ACIDS (3L): Nucleotide structure, purines and Pyrimidine, Functions of nucleic acids, structure of DNA and RNA.</li> <li>• PROTEINS AND AMINO ACIDS (4L): amino acid classification and properties, peptide bond, classification and functions of proteins, enzymes.</li> <li>• CARBOHYDRATES (4L): Structure, functions, classification, chemical and physical</li> </ul>	15

	<p>properties, chemical reactions to detect mono, di and polysaccharides.</p> <ul style="list-style-type: none"> <li>LIPIDS (4L): Classification of lipids Phospholipids: lecithin, Cephalin, Plasmalogen, Triacylglycerol: structure and function, Sterols(cholesterol): structure and function, lipoprotein: structure and function.</li> </ul>	
<p><b>UNIT III</b></p> <p><b>Ultra-structure of micro-organisms</b></p>	<ul style="list-style-type: none"> <li>Prokaryotic Organisation(5L) Classification, types, morphology Detail structure of slime layer, capsule, flagella, pilli, cell wall (gram positive and gram negative) Cell membrane, Cytoplasm and Genetic materials, Storage bodies, Spores formation and Germination</li> <li>Introduction to eukaryotic cell (1L)</li> <li>Viruses (3L) General characters, Classification (Plant, Animal and Bacterial) Structure and morphology of viruses Isolation, Enumeration and Purification of viruses.</li> <li>Introduction of Algae, Fungi(3L)</li> <li>Introduction of Microbial Diversity (3L) Archaeobacteria, Eubacteria, Blue-green Algae, Actinomycetes and Eumycota</li> </ul>	15
	<b>Total</b>	45

**References:**

1. Microbiology. (2001), 5th Edition. Lansing M. Prescott, Harley and Klein. McGraw Hill Higher Education, New York.
2. General Microbiology. (2007) 5th Edition, R. Y. Stainier, J. Ingraham, M. Wheelis and P.R. Painter. Prentice Hall. New Jersey.
3. Microbiology-An Introduction. (1998) 6th Edition. Tortora Funke and Case. Addison Wesley Longman Inc.
4. Thakur IS. (2011) Environmental Biotechnology basic concepts and applications. I. K. International Publishing House Pvt. Limited
5. Evans GM and J. C. Furlong (2003). Environmental Biotechnology: Theory and Applications. Wiley Publishers.
6. Ritmann R and McCarty P L (2000). Environmental Biotechnology: Principle & Applications. 2nd Ed., McGraw Hill Science. 12. Scragg A., (2005) Environmental Biotechnology. Pearson Education Limited.
7. Srinivas TR (2008). Environmental Biotechnology. New Age International Pvt. Ltd.
8. Chapman JL .Ecology: Principal & Application. Cambridge Univ. Press.
9. Textbook of biochemistry 4<sup>th</sup> edition. Leninger

10. Textbook of biochemistry ,3<sup>rd</sup> edition ,U.Satyanarayan.
11. Biotechnology: Environmental Processes- Rehm and Reed-Wiley
12. A Textbook of Biotechnology-Book by R. C. Dubey, S.Chand& Company Ltd

### **PRACTICALS: BH.USBT.MAJ1P1**

1. Isolation of Microorganisms
  - A. Streaking
  - B. Surface spread
  - C. Pour plate
2. Staining of Plant and Animal tissue using single and Double staining techniques.
3. Study of microbial groups with one example
4. Study of photomicrographs of cell organelles.
5. Staining techniques
  - A. Simple staining: Monochrome staining
  - B. Differential staining: Gram staining
  - C. Special staining - Cell wall using Chance's method, Fungal staining
6. Spot test for Carbohydrates, Fats and Proteins and Amino Acids and Nucleic Acids
7. Estimation of Reducing sugar by DNSA method
8. Estimation of Protein by Biuret method and Lowry method
9. Saponification of Fats, Saponification Value of Oil or Fat, Iodine value of Oil and determine the rate constant for the Saponification reaction between ethyl acetate and NaOH by back titration method

<b>Programme: B.Sc. Biotechnology</b>				<b>Semester: I</b>	
<b>Course: Molecular Biology: Overview of Central dogma(MINOR)</b>				<b>Course Code: BH.USBT.MIN101</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme (Theory)</b>	
<b>Lecture (Periods per week)</b>	<b>Practical (Periods per week per batch)</b>	<b>Tutorial (Periods per week per batch)</b>	<b>Credits (Theory+ Practical)</b>	<b>Continuous Internal Assessment (CIA) (CIA-I &amp; II)</b>	<b>End Semester Examination (ESE)</b>
<b>03</b>	<b>03</b>	<b>NIL</b>	<b>3+1=4</b>	<b>40</b>	<b>60</b>
<b>Course Objectives:</b>					
The objective of this course is to understand:					
<ul style="list-style-type: none"> <li>• The concepts of Central Dogma of Life with respect to maintenance of genetic material as well as in</li> </ul>					

terms of gene expression.

**Course Outcomes:**

- By the end of the course the student will be able to gain the complete knowledge of the fundamental molecular processes of the cell such as replication, transcription and translation.

**INDEX**

<b>Units</b>	<b>Detailed Description</b>	<b>Lecture period /unit</b>
<b>UNIT I Replication</b>	<ul style="list-style-type: none"> <li>• Experimental evidences for DNA and RNA as Genetic Material(1L)</li> <li>• Organisation of DNA in chromosome; Overview of Central dogma of Life (2L)</li> <li>• DNA replication: Conservative, Semi-conservative and Dispersive. (2L)</li> <li>• Molecular Models of replication: Unidirectional, Bi-directional, Rolling circle model. (2L)</li> <li>• DNA Replication in Prokaryotes and Eukaryotes: Concepts of leading, lagging strands and Okazaki fragments. (4L)</li> <li>• Initiation, elongation and termination of replication. (4L)</li> </ul>	15
<b>UNIT II Transcription</b>	<ul style="list-style-type: none"> <li>• An Overview of Gene Expression (1L)</li> <li>• Transcription in Prokaryotes : RNA Synthesis, Promoters and Enhancers; (2L)</li> <li>• Initiation, Elongation and Termination of Transcription (3L)</li> <li>• Transcription in Eukaryotes : Eukaryotic RNA polymerases and types; Eukaryotic Promoters, Transcription of Protein coding genes by RNA Polymerase II; Eukaryotic mRNA (5L)</li> <li>• Transcription of other genes by RNA Pol I &amp; III (1L)</li> <li>• Post Transcriptional modifications (2L)</li> <li>• RNA editing (1L)</li> </ul>	15
<b>UNIT III Translation</b>	<ul style="list-style-type: none"> <li>• Translation: a Process of Protein synthesis (2L)</li> <li>• Nature of Genetic Code; Wobble hypothesis (2L)</li> <li>• Process of protein synthesis in prokaryotes and Eukaryotes: Initiation, Elongation, translocation and Termination; (7L)</li> <li>• Post Translation Modifications (2L)</li> <li>• Protein Sorting and Targeting (2L)</li> </ul>	15
	<b>TOTAL</b>	<b>45</b>

**References:**

1. Molecular Cell Biology. 9th Edition, Lodish H., Berk A, Kaiser C., K ReigerM., Bretscher A., Ploegh H., Angelika Amon A., Matthew P. Scott M.P., W.H. Freeman and Co., USA(2021)
2. Molecular Biology of the Cell, 5th Edition Bruce Alberts, Alexander Johnson, Julian Lewis,



- Martin Raff, Keith Roberts, Peter Walter. Garland Science, USA(2008)
3. Cell Biology, 9th edition, Gerald Karp. John Wiley & Sons., USA(2020)
  4. The Cell: A Molecular Approach, 6th edition, Geoffrey M. Cooper, Robert E.Hausman, Sinauer Associates, Inc. USA(2013)
  5. iGenetics A Molecular Approach 3rd Edition Peter J. Russell. (2013)
  6. Molecular Biotechnology-Principles and Applications of Recombinant DNA Technology 3rd Edition Glick B.R., Pasternak J.J., Patten C.L. (2002)
  7. Principles of Gene Manipulation 7th Edition Primrose S.B., Twyman R.M.
  8. Biotechnology 3rd Edition S.S. Purohit.
  9. Genomes 3rd Edition T.A. Brown.
  10. Biotechnology B.D. Singh.
  11. Gene Cloning and DNA Analysis 6th Edition T.A. Brown. 7<sup>th</sup> edition (2016)

**PRACTICALS: BH.USBT.MIN1P1**

- Isolation of genomic DNA
- Isolation of plasmid DNA
- Isolation of RNA
- Visualization using electrophoresis
- Estimation of DNA by DPA method
- Estimation of RNA by orcinol method

<b>Programme: B.Sc. Biotechnology</b>				<b>Semester: I</b>	
<b>Course: F.Y.B.Sc. Nutrition and Wellness(open elective)</b>				<b>Course Code: BH.USBT.OE101</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme (Theory)</b>	
<b>Lecture (Periods per week)</b>	<b>Practical (Periods per week per batch)</b>	<b>Tutorial(Pe riods per week per batch)</b>	<b>Credits (Theory +Practical)</b>	<b>Continuous Internal Assessment (CIA) (CIA-I &amp; II)</b>	<b>End Semester Examination (ESE)</b>
<b>02</b>	<b>NA</b>	<b>NIL</b>	<b>02</b>	<b>40</b>	<b>60</b>
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• To acquire the knowledge about the fundamentals of nutrition and its sources</li> </ul>					
<b>Course Outcomes:</b>					
<ul style="list-style-type: none"> <li>• After completion a student will be able to apply the knowledge to plan/ consult nutritious meals to meet specific dietary guidelines</li> </ul>					

**INDEX**

<b>Units</b>	<b>Detailed descriptions</b>	<b>Lecture period /u</b>
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<p style="text-align: center;"><b>UNIT I</b></p> <p><b>Fundamentals of nutrition</b></p>	<ul style="list-style-type: none"> <li>• Basic terms: Nutrition, malnutrition (over and under), diet and health. 2L</li> <li>• Functions of nutrients (carbohydrates, lipids, proteins, vitamins, minerals, trace elements and water) 3L</li> <li>• Food composition 1L</li> <li>• Digestion, absorption and utilization of carbohydrates, proteins, lipids, vitamins and water. 5L</li> <li>• Factors affecting digestion of food. 2L</li> <li>• RDA and general principles of RDA. 2L</li> </ul>	15
<p style="text-align: center;"><b>UNIT II</b></p> <p><b>Introduction to food groups and cooking methods</b></p>	<ul style="list-style-type: none"> <li>• Food and functions of food 2L <ul style="list-style-type: none"> <li>- physiological functions</li> <li>- social functions</li> <li>- psychological functions</li> </ul> </li> <li>• Food groups: cereals and grains, pulses and legumes, milk and meat products, fruits and vegetables, fats and sugars and super foods. 8L</li> <li>• Meal planning for different age groups 2L</li> <li>• Cooking methods: 5L Moist heat method, Dry heat method, Combination method, Microwave cooking, Solar cooking</li> </ul>	15
<p><b>UNIT III</b></p> <p><b>Disorders of nutrition</b></p>	<ul style="list-style-type: none"> <li>• Protein Energy Malnutrition (PEM) 5L Kwashiorkor, Marasmus, Prevention of PEM through Dietary Management</li> <li>• Obesity 2L</li> <li>• Vitamin A Deficiency 1L</li> <li>• Iron Deficiency Anemia 1L</li> <li>• Vitamin B-Complex Deficiency 1L</li> <li>• Iodine Deficiency Disorders (IDD) 1L</li> <li>• Nutrition is different diseases 4L</li> </ul>	15
<b>TOTAL</b>		<b>45</b>

**References:**

1. Fundamentals of food nutrition and diet therapy, 5<sup>th</sup> edition Sumati.R.Mudambi and M.V.Rajgopal, NewAge International publishers.
2. Krause and Mahan's food and nutrition care process, 15<sup>TH</sup> edition. Janice L Raymond and Kelly Morrow.
3. Textbook of nutrition and dietetics, 2<sup>nd</sup> edition, Kumud Khanna.

**PRACTICALS: BH.USBT.OE1P1**

- Estimation of calcium in milk by using EDTA by titrimetric method
- Estimation of iron in food
- Estimation of Vitamin C

- Estimation of food Composition
- Detection of toxins and adulterants of some of the common food
- Planning ,preparation and nutritional evaluation of diets in relation to activity levels and physiological state.
- To learn cooking of basic recipes of various food groups.
- Determination of protein, carbohydrates and fats in given food sample
- Determination of pH of different food samples
- Determination of reducing and non reducing sugar in food sample

<b>Programme: B.Sc. Biotechnology</b>				<b>Semester: I</b>	
<b>Course: Basic Lab Practices (VSEC)</b>				<b>Course Code: BH.USBT.VSEC101</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme (Theory)</b>	
<b>Lecture (Periods per week)</b>	<b>Practical (Periods per week per batch)</b>	<b>Tutorial (Periods per week per batch)</b>	<b>Credits (Theory+ Practical)</b>	<b>Continuous Internal Assessment (CIA) (CIA-I &amp; II)</b>	<b>End Semester Examination (ESE)</b>
<b>02</b>	<b>02</b>	<b>NIL</b>	<b>2</b>	<b>40</b>	<b>(Marks: 60)</b>
<b>Course Objectives:</b>					
<ul style="list-style-type: none"> <li>• The objective of this course is to have firm foundation of fundamentals of basic lab practices in biological laboratories</li> <li>• To acquaint students with the GLP</li> <li>• To acquaint the students to examining variety of specimens and staining techniques by study of basic principles of optics underlying different microscope.</li> </ul>					
<b>Course Outcomes:</b>					
<ul style="list-style-type: none"> <li>• By the end of the course the student will be able to develop an understanding about various laboratory Practices. A learner acquires the knowledge of use of GLP in designing various experiment</li> <li>• A learner acquires the skills of calibration and validation that helps them to get errorless precise data in any scientific research</li> <li>• The gains the knowledge of safety precaution that are to be taken while handling, using and preserving any pharmaceutical products</li> <li>• Learner learns to apply basic fundamental principles behind staining a specimen, to prepare different types of staining solutions. It teaches students how a simple technique of staining helps in identifying and differentiating a microbe and cells.</li> </ul>					

<b>INDEX</b>		
<b>Units</b>	<b>Detailed descriptions</b>	<b>Lecture period /unit</b>
<b>UNIT I</b>  <b>Introduction To BLP</b>	<ul style="list-style-type: none"> <li>• Good Laboratory practices (2L)</li> <li>• Use and standardization of colorimeter and verification of Beers and Lambert's Law (1L)</li> <li>• Standard solutions and Standardization: Preparation of standard solutions (2L) Standardization of acid and alkali solutions (1L)</li> <li>• Introduction to Titrimetry (1L)</li> <li>• Study of common lab equipments (6L)</li> <li>• Incubator</li> <li>• Autoclave</li> <li>• Oven</li> <li>• Centrifuge</li> <li>• Rotary Shaker</li> <li>• Filter</li> <li>• Laminar air flow unit</li> <li>• Vortex</li> <li>• Magnetic stirrer</li> <li>• Weighing balance</li> <li>• Graph Analysis (1L)</li> <li>• SOP (1L)</li> </ul>	15
<b>UNIT II</b>  <b>Visualizing specimens using Light Microscopy</b>	<p>Microscopy: (8L)</p> <ul style="list-style-type: none"> <li>• Study of different terminology:</li> <li>• Focal length Refraction, Reflection Numerical aperture, Magnification power, Resolution and Resolving power, working distance of covered and uncovered object</li> <li>• Simple and Compound: Principle. Parts, Functions and Applications</li> <li>• Dark Field and Phase Contrast Microscope, Fluorescent microscope,</li> <li>• Microscopic aberration</li> </ul> <p>Electron Microscopy: (7L)</p> <ul style="list-style-type: none"> <li>• Principles and working of electron microscopes</li> <li>• Types of Electron microscope: SEM and TEM</li> <li>• Parts of Electron Microscope: Electron gun, Electromagnetic lenses, Specimen Holder, Image viewing and Recording system</li> </ul>	15

	<ul style="list-style-type: none"> <li>• Applications of Electron microscope</li> <li>• Advantages of Electron microscope</li> <li>• Limitations of Electron microscope</li> </ul>	
<b>UNIT III</b>  <b>Staining &amp; sample preparation</b>	<ul style="list-style-type: none"> <li>• Definition of terminology: Dye and Chromogen. Structure of Dye and Chromophore, Functions of Mordant and Fixative, Leuco-compounds.</li> <li>• Natural and Synthetic Dyes.</li> <li>• Preparation and observations of specimens to observe under compound microscope through staining: Simple Staining, Differential Staining and Acid-Fast Staining, Special staining, Polychrome staining with specific examples</li> <li>• Sample Preparations for SEM, TEM, Fluorescence Microscopes. 4L</li> <li>• Preparation and Staining of Electron and other microscopes. 4L</li> </ul>	<b>15</b>
	<b>TOTAL</b>	<b>30</b>
<b>References:</b> <ul style="list-style-type: none"> <li>• Molecular Biotechnology –Principles and Applications of Recombinant DNA Glick, B.R,Pasternak, J.J Patten, C.L 3rd edition ASM press</li> <li>• Sambrook</li> <li>• Freshney</li> <li>• Rodney F Boyer(2012) Biochemistry laboratory: modern theory and techniques.2nd Edition, Pearson Prentice Hall, Boston,USA.</li> <li>• R. Katoch(2011) Analytical techniques in biochemistry and molecular biology,Springer, New York.</li> <li>• Lansing M. Prescott, (2019),Harley Microbiology. 11th Edition and Klein. McGraw Hill Higher Education, New York.</li> <li>• Tortora Funke and CaseAddison Wesley(2010), Microbiology-An Introduction. 10 th Edition. Longman Inc.</li> <li>• A.J. Salle (1984)Fundamental Principles of Bacteriology. Tata McGraw-Hill Education.</li> </ul>		
<b>Practicals : BH.USBT.VSEC1P1</b> <ul style="list-style-type: none"> <li>• Introduction to pipettes, measuring cylinders and other vessels used in the laboratory</li> <li>• Preparation of staining solutions</li> <li>• Use and standardization of pH meter Preparation of buffers</li> <li>• Aseptic transfer technique</li> <li>• Gel electrophoresis, Vertical and horizontal</li> <li>• Staining techniques</li> <li>• Simple staining: Monochrome staining</li> </ul>		

- Differential staining: Gram staining
- Fungal staining

<b>Programme: B.Sc. Biotechnology</b>				<b>Semester: I</b>	
<b>Course: F.Y.B.Sc.: Ayurveda: The root of Indian Medical Science (IKS)</b>				<b>Course Code: BH.USBT.IKS101</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme (Theory)</b>	
<b>Lecture (Periods per week)</b>	<b>Practical (Periods per week per batch)</b>	<b>Tutorial(Pe riods per week per batch)</b>	<b>Credits (Theory +Practical)</b>	<b>Continuous Internal Assessment (CIA) (CIA-I &amp; II)</b>	<b>End Semester Examination (ESE)</b>
<b>2</b>	<b>NA</b>	<b>NA</b>	<b>2</b>	<b>NA</b>	<b>50</b>
<b>Course Objectives:</b> To expose students to our Indian original medicine and its scope					
<b>Course Outcomes:</b> The students will gain basic knowledge and understanding on basic principles of Ayurveda, Panmahabhutha, Tridosha, Sidhantha, Sapthdathus and Padachathushtayametc					

<b>Course: F.Y.B.Sc.: Communication skills (AEC)</b>				<b>Course Code: BH.USBT.AEC101</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme (Theory)</b>	
<b>Lecture (Periods per week)</b>	<b>Practical (Periods per week per batch)</b>	<b>Tutorial (Periods per week per batch)</b>	<b>Credits (Theory +Practical)</b>	<b>Continuous Internal Assessment (CIA) (CIA-I &amp; II)</b>	<b>End Semester Examination (ESE)</b>
<b>02</b>	<b>NIL</b>	<b>NIL</b>	<b>02</b>	<b>NA</b>	<b>50</b>

<b>INDEX</b>		
<b>Units</b>	<b>Detailed descriptions</b>	<b>Lecture period /unit</b>
<b>UNIT I</b>	<ul style="list-style-type: none"> <li>• History and origin of Ayurveda, origin and scope</li> <li>• Basic Principles of Ayurveda and its importance</li> <li>• PanchamahabhuthaSidhantha&amp;TridoshaSidhantha and relationship between two Body constitution-concept and identification</li> <li>• Role of body constitution in therapeutic procedure</li> </ul>	15
<b>UNIT II</b>	<ul style="list-style-type: none"> <li>• Sapthdathus, Symptoms of increase and decrease</li> <li>• Ojas</li> <li>• Padachathushtayam</li> <li>• Agni Concept and type</li> <li>• Holistic concept of health</li> <li>• Role of DincharyaRitucharya</li> <li>• Reverse Therapy</li> </ul>	15
	<b>TOTAL</b>	<b>30</b>
<b>References:</b>		
<ol style="list-style-type: none"> <li>1. K.R srikantha Murthy, 2016, Sushruta Samhita, , Chaukhambha Orientalia</li> <li>2. Yogini S. Jaiswal and Leonard L. Williams (2017), A glimpse of Ayurveda-The forgotten history and principles of Indian traditional medicine. JTCM 50-53</li> </ol>		

**Course Objectives:** To develop good communication skills amongst the students which will enhance their personality and confidence

**Course Outcomes:**

- To know about various aspects of soft skills and learn ways to develop personality.
- To understand the importance and type of communication in personal and professional environment.

**INDEX**

Units	Detailed descriptions	Lecture period /unit
<b>UNIT I</b>  <b>Communication and listening</b>	<ul style="list-style-type: none"> <li>• Communication Concept, nature and significance of communication process (1L) Elements of communication (2L) Types of communication (2L) Verbal and nonverbal communication (3L) Formal and informal communication (2L) Barriers in communication and overcoming barriers (2L)</li> <li>• Reading, listening skills, five fundamentals of effective listening and note-taking skills (2L)</li> <li>• Writing skills: Field diary and laboratory record (1L)</li> </ul>	15
<b>UNIT II</b>  <b>Soft skills</b>	<ul style="list-style-type: none"> <li>• Employment communication: Introduction, resume, curriculum vitae, different forms of resumes, job application, cover letter (5L)</li> <li>• Professional presentation: Nature of presentation, planning, preparing and delivering a presentation, formal and informal presentation, body language (5L)</li> <li>• Interviews: Introduction, types of interviews, preparatory steps for interviews (3L)</li> <li>• Public speaking and its importance (2L)</li> </ul>	15
	<b>TOTAL</b>	<b>30</b>

**References:**

Communication skills by Meenakshi Raman and Sangeeta Sharma, oxford press  
 Personality Development and Soft Skills, Barun K. Mitra, Oxford Press  
 Soft Skills- Enhancing Employability, M. S. Rao, I. K. Internation



<b>Programme: B.Sc. Biotechnology</b>				<b>Semester: I</b>	
<b>Course: F.Y.B.Sc.: QA&amp;QC (VEC)</b>				<b>Course Code: BH.USBT.VEC101</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme (Theory)</b>	
<b>Lecture (Periods per week)</b>	<b>Practical (Periods per week per batch)</b>	<b>Tutorial (Periods per week per batch)</b>	<b>Credits (Theory +Practical)</b>	<b>Continuous Internal Assessment (CIA) (CIA-I &amp; II)</b>	<b>End Semester Examination (ESE)</b>
<b>02</b>	<b>NA</b>	<b>NIL</b>	<b>02</b>	<b>NA</b>	<b>50</b>
<b>Course Objectives:</b> The objective of this course is to impart knowledge to the students about concept of quality control and quality assurance in various of fields like biotechnology, pharmaceuticals etc					
<b>Course Outcomes:</b> students will understand the importance of QA&QC in different fields and will have a clear idea about production of good quality products.					

<b>INDEX</b>		
<b>Units</b>	<b>Detailed descriptions</b>	<b>Lecture period /unit</b>
<b>UNIT I</b>  <b>Basics of GMP, QA &amp; QC</b>	<ul style="list-style-type: none"> <li>• GMP Concept of GMP 1L Requirements of GMP implementation 2L Documentation of GMP practices 2L Regulatory certification of GMP 2L</li> <li>• Quality control: Concept of QC 2L Requirements for implementing QC 2L</li> <li>• Concept of QA, requirements for implementing QA 4L</li> </ul>	15
<b>UNIT II</b>  <b>GMP for pharmaceutical products</b>	Assessment of pharmaceutical water system:3L Good Manufacturing Practice (GMP) for pharmaceutical Products :8L <ul style="list-style-type: none"> <li>• Pharmaceutical ingredients susceptible to microbial attack</li> <li>• Observable effects of microbial attack on pharmaceutical products</li> <li>• Factors affecting microbial spoilage of pharmaceutical products</li> <li>• Hazard to health Sources and control of contamination</li> <li>• The extent of microbial contamination</li> <li>• Factors determining the outcome of medicament - borne</li> <li>• Infection Preservation of medicines using antimicrobial agents: basic principles</li> <li>• Quality assurance and the control of microbial risk in medicines</li> <li>• Quality control testing of pharmaceutical products with suitable example:4L</li> </ul>	15
	<b>TOTAL</b>	<b>30</b>
<b>References:</b> Pharmaceutical microbiology by Russel &Hugo		

## Semester –II

<b>Programme: B.Sc. Biotechnology</b>				<b>Semester: II</b>	
<b>Course: F.Y.B.Sc.: Basic Biotechnology II (MAJOR)</b>				<b>Course Code: BH.USBT.MAJ201</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme (Theory)</b>	
<b>Lecture (Periods per week)</b>	<b>Practical (Periods per week per batch)</b>	<b>Tutorial(Pe riods per week per batch)</b>	<b>Credits (Theory +Practical)</b>	<b>Continuous Internal Assessment (CIA) (CIA-I &amp; II)</b>	<b>End Semester Examination (ESE)</b>
<b>3</b>	<b>1</b>	<b>NA</b>	<b>4</b>	<b>40</b>	<b>60</b>
<b>Course Objectives:</b>					
To acquaint students with basic concepts in Mendelian and post Mendelian Genetics.					
To familiarize the students in with basic techniques on sterilization and disinfection used in microbiology.					
To familiarize the students in with ecosystem and environment.					
<b>Course Outcomes:</b>					
1. To impart skills to analyze the problems based on Mendelian genetics					
2. Demonstrate various laboratory experiments while maintaining a sterile environment					
3. Apply appropriate sterilization techniques depending on the need of the experiment					
4. Understand the importance of pollution free environment and biotechnological solutions to address various environmental issues.					
5. Understand the application of different life forms in environmental remediation					

# INDEX

Units	Detailed descriptions	Lecture period /unit
<b>UNIT I</b>  <b>Fundamentals of Genetics</b>	<ul style="list-style-type: none"> <li>● Mendel's Principle in Human Genetics. Mendel's experiments – Factors contributing to success of Mendel's experiments. (2)</li> <li>● Mendel's laws - Law of segregation – Monohybrid ratio, Dihybrid cross. Law of Independent assortment. (3)</li> <li>● Deviation from Mendel's Laws - partial or incomplete dominance, co-dominance. (2)</li> <li>● Penetrance and expressivity, Pleiotropism (1)</li> <li>● Gene interaction – Modified dihybrid ratios (12:3:1; 9:7; 15:1; 9:3:4: 9:6:1; 13:3). (4)</li> <li>● Multiple Alleles: Drosophila eye color ABO blood groups &amp; Rh factor. Allelic series. (3)</li> </ul>	15
<b>UNIT II:</b> <b>Sterilization and disinfection</b>	<ul style="list-style-type: none"> <li>● Definition, Terminology related to sterilization and disinfection. Factors affecting the action antimicrobial agent :2</li> <li>● Physical control of microorganisms; Types and applications :7               <ul style="list-style-type: none"> <li>a. Use of heat (Concept of TDT, TDP, 12D, F , Z value and its scope in food preservation) Dry Heat, Steam under pressure,</li> <li>b. Low temperature</li> <li>c. Desiccation</li> <li>d. Radiation</li> <li>e. Filtration</li> <li>f. Osmotic pressure</li> </ul> </li> <li>● Chemical control of microorganisms: 4               <ul style="list-style-type: none"> <li>a. Characteristics of ideal disinfectant, examples of Disinfectant their mode of action and applications</li> <li>b. Aldehydes,</li> <li>c. Halogens,</li> <li>d. Quaternary Ammonium Compounds,</li> <li>e. Phenol and Phenolic Compounds,</li> <li>f. Heavy Metals,</li> <li>g. Alcohol,</li> <li>h. Dyes</li> <li>i. Detergents</li> <li>j. Gaseous disinfectant</li> </ul> </li> <li>● Evaluation of a disinfectant: 2</li> </ul>	15
<b>UNIT III</b>  <b>Environmental Biotechnology</b>	<ul style="list-style-type: none"> <li>● Ecology 5L Structure and Function of ecosystem.</li> <li>● Nutrient and Biogeochemical cycles: Water, Carbon, Oxygen, Nitrogen and Sulphur</li> <li>● Environment and pollution: 5L</li> <li>● Pollutants: Nature, origin, source, monitoring and their impacts.</li> <li>● Air, Water, Solid waste pollution and treatments</li> </ul>	15

	<ul style="list-style-type: none"> <li>• Green House effect, Global warming</li> <li>• Kyoto protocol</li> <li>• Bioremediation 5L</li> <li>• Concept of Bioremediation, Mycoremediation &amp; Phytoremediation, Bioaugmentation and Biostimulation</li> </ul>	
	<b>Total</b>	<b>45</b>

**References:**

1. Microbiology. (2001), 5th Edition. Lansing M. Prescott, Harley and Klein. McGraw Hill Higher Education, New York.
2. General Microbiology. (2007) 5th Edition, R. Y. Stainier, J. Ingraham, M. Wheelis and P.R. Painter. Prentice Hall. New Jersey.
3. Microbiology-An Introduction. (1998) 6th Edition. Tortora Funke and Case. Addison Wesley Longman Inc.
4. Thakur IS. (2011) Environmental Biotechnology basic concepts and applications. I. K. International Publishing House Pvt. Limited
5. Evans GM and J. C. Furlong (2003). Environmental Biotechnology: Theory and Applications. Wiley Publishers.
6. Ritmann R and McCarty P L (2000). Environmental Biotechnology: Principle & Applications. 2nd Ed., McGraw Hill Science. 12. Scragg A., (2005) Environmental Biotechnology. Pearson Education Limited.
7. Srinivas TR (2008). Environmental Biotechnology. New Age International Pvt. Ltd.
8. Chapman JL. Ecology: Principal & Application. Cambridge Univ. Press.

**PRACRICALS: BH.USBT.MAJ2P1**

1. Sterilization using moist heat (autoclave), dry heat (Oven) and filtration (bacteria proof membrane filters)
2. Oligodynamic action of heavy metals
3. Effect of dyes on growth of microorganism
4. Determination of phenol coefficient.
5. Assessment of potability of water.
6. BOD estimation of polluted water.
7. COD estimation of polluted water.
8. Visit to an Effluent treatment or Wastewater treatment Plant.

<b>Programme: B.Sc. Biotechnology</b>		<b>Semester: II</b>
<b>Course:</b>	<b>Advanced molecular biology: Regulation of gene expression (MINOR)</b>	<b>Course Code:</b> BH.USBT.MIN201
<b>Teaching Scheme</b>		<b>Evaluation Scheme (Theory)</b>

Lecture (Periods per week)	Practical (Periods per week per batch)	Tutorial (Periods per week per batch)	Credits (Theory+ Practical)	Continuous Internal Assessment (CIA) (CIA-I & II)	End Semester Examination (ESE)
03	03	NIL	3+1=4	40	60

**Objective:**

- To gain insight of the regulation of gene expression in prokaryotes and eukaryotes

**Outcomes:**

- The student will be able to understand the levels of prokaryotic and eukaryotic gene expression and apply the knowledge in the specific regulation studies

**INDEX**

Unit	Topic	Lecture period /unit
<b>Unit-I: Regulation of Gene Expression in Bacteria &amp; Bacteriophages</b>	<p><b>In Bacteria:</b></p> <ul style="list-style-type: none"> <li>Concept of Operon (2L)</li> <li>lac Operon of E. coli: Jacob and Monod's operon model; molecular details of lac Operon regulation (4L)</li> <li>trp Operon of E. coli: Gene Organization of n Tryptophan Biosynthesis Genes and its regulation (3L)</li> <li>ara Operon of E. coli: Positive and Negative control (2L)</li> </ul> <p><b>In phage lambda:</b></p> <ul style="list-style-type: none"> <li>Early Transcription events (2L)</li> <li>The lysogenic Pathway (1L)</li> <li>The lytic Pathway (1L)</li> </ul>	15
<b>Unit-II Regulation of Gene Expression in Eukaryotes: Regulation of Transcription</b>	<ul style="list-style-type: none"> <li>Levels of control of gene expression eukaryotes (2L)</li> <li>Control of Transcriptional Initiation by regulatory proteins: Activators and Repressors (4L)</li> <li>Combinatorial gene regulation and case studies: Yeast galactose utilization genes; steroid hormones (4L)</li> <li>Role of chromatin in gene regulation: repression of gene activity by histones; chromatin remodeling (3L)</li> </ul>	15

	<ul style="list-style-type: none"> <li>Gene Silencing and Genomic Imprinting (2L)</li> </ul>	
<b>UNIT III</b> <b>Regulation of Gene Expression in Eukaryotes: RNA processing control</b>	<ul style="list-style-type: none"> <li>Post-Transcriptional Control (2L)</li> <li>Alternate polyadenylation and splicing (2L)</li> <li>Translation control by ribosome selection</li> <li>RNA Interference: Gene silencing (4L)</li> <li>mRNA and protein degradation (2L)</li> </ul>	15
	<b>TOTAL</b>	<b>45</b>

**References:**

- Molecular Cell Biology. 9th Edition, Lodish H., Berk A, Kaiser C., K ReigerM., Bretscher A., Ploegh H., Angelika Amon A., Matthew P. Scott M.P., W.H. Freeman and Co., USA(2021)
- Molecular Biology of the Cell, 5th Edition Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. Garland Science, USA(2008)
- Cell Biology, 9th edition, Gerald Karp. John Wiley & Sons., USA(2020)
- The Cell: A Molecular Approach, 6th edition, Geoffrey M. Cooper, Robert E. Hausman, Sinauer Associates, Inc. USA(2013)
- iGenetics A Molecular Approach 3rd Edition Peter J. Russell. (2013)
- Molecular Biotechnology-Principles and Applications of Recombinant DNA Technology 3rd Edition Glick B.R., Pasternak J.J., Patten C.L. (2002)
- Principles of Gene Manipulation 7th Edition Primrose S.B., Twyman R.M.
- Biotechnology 3rd Edition S.S. Purohit.
- Genomes 3rd Edition T.A. Brown.
- Biotechnology B.D. Singh.
- Gene Cloning and DNA Analysis 6th Edition T.A. Brown. 7<sup>th</sup> edition (2016)

**PRACRICALS: BH.USBT.MIN2P1**

Analysis of protein by PAGE

Bacterial gene expression studies using blue white screening

Analysis of regulatory elements in DNA using softwares

<b>Programme: B.Sc. Biotechnology</b>				<b>Semester: II</b>	
<b>Course: F.Y.B.Sc. :IPR and Bioethics (OPEN ELECTIVE)</b>				<b>Course Code: BH.USBT.OE201</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme (Theory)</b>	
<b>Lecture (Periods per week)</b>	<b>Practical (Periods per week per batch)</b>	<b>Tutorial (Periods per week per batch)</b>	<b>Credits (Theory +Practical)</b>	<b>Continuous Internal Assessment (CIA) (CIA-I &amp; II)</b>	<b>End Semester Examination (ESE)</b>
2	Nil	Nil	2	40	60
<b>Course Objectives:</b> The objective of the course is to familiarize the students with principles of bioethics					
<b>Course Outcomes:</b> On completion of the course, the students will be able to:					

- Knowledge regarding ethics to be followed during biological experiments and research

### INDEX

Units	Detailed descriptions	Lecture period /unit
<b>UNIT I</b>  <b>Understand and Overview if the IPR</b>	<ul style="list-style-type: none"> <li>• Introduction, types of Intellectual property- Industrial property, Artistic and Literary Property (3),</li> <li>• Need for Intellectual property rights, Rationale for protection of IPR (2),</li> <li>• Impact of IPR on Development, health, agriculture and genetic resources (2),</li> <li>• IPR in India- Genesis and Development (2)</li> <li>• Introduction of: Patents; Trademarks; Copyrights; Geographical Indications; Industrial designs (6).</li> </ul>	15
<b>UNIT II</b>  <b>Patents</b>	<ul style="list-style-type: none"> <li>• Plant application, International patenting and patent cooperation treaty (2);</li> <li>• Use of technical information in patent documents (2);</li> <li>• Revocation of patent; patenting of biological material; Trade secret; Geographical Indications;</li> <li>• Industrial designs (3).</li> <li>• Plant breeders rights (2);</li> <li>• Functions of UPOV (1);</li> <li>• Farmers rights (1);</li> <li>• Convention of biodiversity (2);</li> <li>• Plant variety protection (2)</li> </ul>	15
<b>UNIT II</b>  <b>Bioethics</b>	<ul style="list-style-type: none"> <li>• What is ethics, History and Introduction (1)</li> <li>• Ethical issues: Social, legal and Environmental: (2)</li> <li>• Examples related to ethical issues in biotechnology, molecular biology and medical and clinical trials (positive and negative effects) (7)</li> <li>• Case studies:(5)</li> </ul>	15
	<b>TOTAL</b>	<b>45</b>

Programme: B.Sc. Biotechnology	Semester: I
Course: F.Y.B.Sc. :Fermentation Biotechnology (VSEC)	Course Code: BH.USBT.VSEC201

Teaching Scheme				Evaluation Scheme (Theory)	
Lecture (Periods per week)	Practical (Periods per week per batch)	Tutorial(Per iods per week per batch)	Credits (Theory +Practical)	Continuous Internal Assessment (CIA) (CIA-I & II)	End Semester Examination (ESE)
3	1	NA	3+2	40	60
<b>Course Objectives:</b> The objective of this course is to understand the basic skills applied in Fermentation Technology and build a foundation for more advanced studies in Industrial biotechnology.					
<b>Course Outcomes:</b> By the end of the course the student will be able to <ul style="list-style-type: none"> <li>• Develop skills associated with screening of Industrially Important Strains</li> <li>• Understand principles underlying design of Fermenter and Fermentation Process</li> <li>• Produce quality wine in small scale</li> </ul>					

INDEX		
Units	Detailed descriptions	Lecture period /unit
UNIT I  Upstream processes in fermentation	Screening and Maintenance of Strains: Primary Screening and Secondary Screening:4L Preservation of Industrially Important Microbial Strains.3 L Inoculum development for bacteria, yeast and fungi:4L Fermentation Media: Components; Design and Sterilization 4L	15
UNIT II Fermenter design, sterilization and methods of fermentation	Design of a fermenter : - Basic Design; Parts of a Typical Industrial Fermentor, Process Parameters: pH, Temperature, Aeration, Agitation, Foam, pressure, dissolved oxygen, flow and load etc.6 L Fermenter sterilization 2L Types of Fermentation: Batch, Continuous, Surface, Submerged, solid-state, aerobic and anaerobic with one suitable example 7L	15
UNIT 3 Applications of fermentation technology in wine making	Wine production Preplanting Activities; Planting Vines , Steps Immediately After Planting ,Defruiting , Managing Shoot Growth Managing Row Middles , Engineering A Modern Trellis, Typing, Grapevines , Managing the Canopy; Controlling Crop; Harvesting 5L	



	Introduction to alcoholic fermentation 1L Parameters influencing wine production 2L Different types of yeasts involved in wine production 1L Bacterial processes during wine making 1L Technological aspects of wine making 2L Aroma components of wine 1 Types of wine 2L	
Practical BH.USBT.V SEC2P1	A. Lab scale production of wine 1. Isolation of alcohol fermenting yeast 2. Production of wine using different raw materials B. Quality control of wine 1. Testing organoleptic properties 2. Testing microbial load 3. Measurement of alcohol concentration 4. Measurement of sugar concentration	1
	TOTAL	30

References:

1. L. E. Casida. (1991) .Industrial Microbiology. (1st ed) Wiley Publisher. John Wiley & Sons Canada, Limited,
2. P. F. Stanbury and A. Whitaker, (2003) Principles of Fermentation Technology (2nd Edition). Elsevier Science Ltd
3. A. H. Patel (1996), Industrial Microbiology. (1st ed) Macmillan India Ltd.  
+Reference book
4. E. M. T. El-Mansi, C. F. A. Bryce, (1999) Fermentation Microbiology and Biotechnology. CRC press
5. W. Crueger and A. Crueger. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.

<b>Programme: B.Sc. Biotechnology</b>				<b>Semester: II</b>	
<b>Course: Bioinformatics</b>				<b>Course Code: BH.USBT.VEC201</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme (Theory)</b>	
<b>Lecture (Periods per week)</b>	<b>Practical (Periods per week per batch)</b>	<b>Tutorial( Periods per week per batch)</b>	<b>Credits (Theory+ Practical)</b>	<b>Continuous Internal Assessment (CIA) (CIA-I &amp; II)</b>	<b>End Semester Examination (ESE)</b>
02	02	NIL	2	NIL	50
<b>Course Objectives:</b> The objective of this course is to understand <ul style="list-style-type: none"> <li>• The objective of this course is learning and understanding basic concepts of Bioinformatics</li> </ul>					
<b>Course Outcomes:</b> By the end of the course the student will be able to <ol style="list-style-type: none"> <li>1. Gain an understanding of the basic concepts of Bioinformatics</li> <li>2. Understand the tools used in bioinformatics.</li> <li>3. Apply the various bioinformatical tools for analysis of biological data</li> </ol>					

<b>INDEX</b>		
<b>Units</b>	<b>Detailed descriptions</b>	<b>Lecture period /unit</b>
<b>UNIT I</b> <b>Introduction to Bio-informatics and Biological Databases</b>	<ul style="list-style-type: none"> <li>• Bioinformatics and its relation with molecular biology (1L)</li> <li>• Applications of Bioinformatics(1L)</li> <li>• Biological Databases: Classification of Databases - Raw and</li> <li>• Processed databases (2L)</li> <li>• Primary (NCBI), Secondary (PIR) and Tertiary or Composite (KEGG) databases; Structure and Sequence databases (4L)</li> <li>• Specialized Databases - Protein Pattern Databases; Protein Structure and Classification Databases (CATH/SCOP) (4L)</li> <li>• Genome Information Resources: DNA Sequence Databases (2L)</li> <li>• Protein Databases based on Composition (1L)</li> </ul>	<i>15</i>
<b>UNIT II</b> <b>BLAST and Sequence Alignment</b>	<ul style="list-style-type: none"> <li>• BLAST and its Types (2L)</li> <li>• Retrieving Sequence using BLAST (1L)</li> <li>• Pairwise Alignment: Identity and Similarity; Global and Local Alignment; Pairwise Database Searching (4L)</li> <li>• Multiple Sequence Alignment: Goal of Multiple Sequence Alignment; Computational Complexity; Manual Methods (4L)</li> <li>• Simultaneous Methods; Progressive Methods; Databases of Multiple Alignment; Secondary Database Searching; Analysis Packages; MSA and phylogenetic trees (4L)</li> </ul>	15
	<b>TOTAL</b>	<b>30</b>
<p><b>References :</b></p> <p>1. Bioinformatics- methods and S.C.Rastogi, N. Mendiratta, PHL learning Pvt. Ltd. applications Genomics, Proteomics P.Rastogi 3rd edition.</p> <p>2. Introductory Biostatistics. 1st edition. (2003), Chap T. Le. John Wiley, USA</p>		

<b>Programme: B.Sc. Biotechnology</b>				<b>Semester: II</b>	
<b>Course: F.Y.B.Sc. : SCIENTIFIC COMMUNICATION (AEC)</b>				<b>Course Code: BH.USBT.AEC201</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme (Theory)</b>	
<b>Lecture (Periods per week)</b>	<b>Practical (Periods per week per batch)</b>	<b>Tutorial(Periods per week per batch)</b>	<b>Credits (Theory +Practical)</b>	<b>Continuous Internal Assessment (CIA) (CIA-I &amp; II)</b>	<b>End Semester Examination (ESE)</b>
<b>02</b>	<b>NA</b>	<b>NIL</b>	<b>02</b>	<b>NIL</b>	<b>50</b>
<b>Course Objectives:</b> To develop an understanding in students to learn skills in scientific writing and develop research plan					
<b>Course Outcomes:</b> students will learn the skills required for generating documents required in research work					

<b>INDEX</b>		
<b>Units</b>	<b>Detailed descriptions</b>	<b>Lecture period /unit</b>
<b>UNIT I</b>  <b>Research plan and data collection</b>	<ul style="list-style-type: none"> <li>• Process of scientific writing: thinking, planning, rough drafts and revising contents.4L</li> <li>• Introduction to scientific reports and writing, compilation of experimental data, communication methods in science, writing papers, reviews, bibliography.5L</li> <li>• Developing research plan:6L</li> <li>• Collection of primary data</li> <li>• Observation method, interview method, collection of data through questionnaires, data collection through schedules, collection of secondary data: appropriate method for data collection</li> </ul>	15
<b>UNIT II</b>  <b>Interpretation and report writing</b>	<ul style="list-style-type: none"> <li>• Interpretation: Meaning of interpretation, importance of interpretation, technique of interpretation, precaution in interpretation.4L</li> <li>• Report writing: significance, different steps in writing report, layout of research report, types of reports, oral presentations, precautions for writing research reports. 6L</li> <li>• Case study: meaning and types, importance and steps in case study. 3L</li> <li>• Plagiarism: Meaning, types and examples .2L</li> </ul>	15
<b>TOTAL</b>		<b>30</b>
<b>References:</b> Research methodology: methods and techniques, C.R. Kothari, New age international publishers 2004 Handbook of science and communication, Vijay Kumar Singh, A.B.D publishers		

