



M. C. E. Society's

Abeda Inamdar Senior College

Of Arts, Science and Commerce, Camp, Pune-1

(Autonomous) Affiliated to Savitribai Phule Pune University

NAAC accredited 'A' Grade

Syllabus for (F.Y.B.Sc Vocational Biotechnology)

(CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Basics of Biochemistry
Course Code	21SBBT111
Semester	1
No. of Credits	2 (36 lectures of 50 minutes)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To study the structure, composition, and chemical reactions of substances in living systems
2.	To explore the structures and functions of cellular components, including proteins, carbohydrates, and lipids
3.	The course will aid the students in understanding other topics like enzymes, substrate and catalyst
4.	To explains how organisms adapt to their changing environments and gradually evolve

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	The subject will comprehend the importance of chemical foundation in living organisms.

2.	The students can analyze the various types of weak interactions between the biomolecules and water
3.	Students can correlate how the large biomolecules such as proteins, carbohydrates, lipids, nucleic acids are made from the simple precursors
4.	Students can interpret the structure-function relationships of the proteins, carbohydrates, and lipids
5.	Students will also get basic knowledge of enzymology

Syllabus

Unit No.	Title with Contents	No. of Lectures
Unit I	Water and Biomolecule I	18
	1. The foundations of biochemistry i. Cellular and chemical foundations of life	4
	2. Water i. Unique properties, weak interactions in aqueous systems, ionization of water, buffers, water as a reactant and fitness of the aqueous environment.	4
	3. Carbohydrates and glycobiology – i. Introduction ii. Monosaccharides: Structure and properties, ketoses and aldoses, D and L configuration, mutarotation, epimers & anomers. iii. Oligosaccharide: reducing and non-reducing sugars, Inversion of sugar. iv. Polysaccharide and its classification based on function, Storage polysaccharides (Starch, Glycogen and Inulin), Structural polysaccharides (Cellulose, Chitin). v. Functions of carbohydrates.	10
Unit II	Enzymology and Biomolecule II	18
1	1. Amino acids & Proteins i. Structure and properties of amino acids, Classification of amino acids. ii. Chemistry of amino acids: Acid-base behavior,	7

	reactions of amino acids, Zwitter ion, Titration of amino acid, isoelectric pH. iii. Protein structure: Primary structure & peptide bond formation, Secondary structure, Tertiary structure, Quaternary structure (Hb as example)	
	2. Lipids- i. Introduction ii. Classification of lipids, fatty acids, physical and chemical properties of lipids. iii. Simple lipids, Complex lipids, Steroids, Structural & Storage lipids. iv. Functions of lipids.	6
	3. Enzymes – i. Introduction ii. Lock and key hypothesis and Induce Fit model iii. Effect of enzyme activity on, substrate concentration, pH and temperature.	5

References:

1. Eric Conn & Paul Stumpf - Outlines of Biochemistry, 5th Edition , John Wiley and Sons, USA.
2. Donald Voet & Judith Voet- Fundamentals of Biochemistry. 3rd Edition, (2008), John Wiley and Sons, USA.
3. Jeffery Zubey - Principles of Biochemistry, 4th edition, McGraw-Hill College, USA
4. David Nelson & Michael Cox,- Lehninger, Principles of Biochemistry. 5th Edition, W.H. Freeman and company, NY
5. Reginald Garrett and Charles Grisham, Biochemistry. 5th Edition, Brook/Cole, Cengage Learning, Boston, USA.
6. S. Sadashivam, A. Manickam- Biochemical Methods, 1st-New Age International Publishers, India.



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F.Y.B.Sc Vocational Biotechnology

(CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Introduction to fields of Biotechnology
Course Code	21SBBT112
Semester	I
No. of Credits	2 (36 lectures of 50 minutes)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To familiarize students with the Basics of Biotechnology.
2.	To introduce the different branches of biotechnology
3.	To understand the role of biotechnology in day to day life
4.	To understand the application of each branch of biotechnology
5.	To present to the students the milestones and developments in Biotechnology

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will understand the applications of biotechnology.
2.	Students will be acquainted with the different branches of biotechnology.
3.	Students will understand the importance of biotechnology in Day to

	Day Life.
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Syllabus

Unit No	Title with Contents	No. of Lectures
Unit I	Introduction to Biotechnology and applications of Biotechnology in the field of medicine and agriculture	18
	1. Introduction to Biotechnology - i. Milestones in the History of Biotechnology ii. Introduction & Branches of Biotechnology iii. Biotechnology in day to day life	6
	2. Application of Biotechnology in the field of medicine - i. Disease diagnosis & Prognosis ii. Concept of Stem cells & Regenerative medicine iii. Vaccine	6
	3. Application of Biotechnology in agriculture - i. Biofertilizers & Biopesticides ii. Introduction to GMOs with examples iii. Role of Biotechnology in Agriculture	6
Unit I	Other opportunities in Biotechnology and applications of Biotechnology in the field of environment and industry.	18
	1. Role of Biotechnology in solving problems related to environment – i. Biosensors ii. Waste water treatment iii. Bioremediation iv. Biofuels	6
	2. Role of biotechnology in Food & Dairy industry- i. Prebiotics and Probiotics ii. Functional foods iii. Nutraceuticals	6

	iv. Single cell protein v. Food safety 3. Other opportunities in Biotechnology – i. In Research ii. In Industry, Start-ups & Entrepreneurship 4. Visit to Biotech Industry / Research Institute and report writing -	 4 2
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References:

1. J. A. Davis, W. S. Resnikoff- Milestones in Biotechnology: Classic papers in Genetic Engineering.
2. J. Hammond & P. McGravey, V.Yushibov - Plant biotechnology , Springer-Verlag.
3. Amann, R.I. Stromley, J. Stahl - Applied & Environmental Microbiology
4. B. D. Singh- A textbook of Biotechnology, 4th Edition, Publisher: Kalyani
5. Primrose and Twyman -Principles of Gene Manipulation & Genomics , (2006, 7th Edition), Blackwell Publishing

F.Y.B.Sc Vocational Biotechnology

(CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Lab Course I: Practical in Basic Biochemistry
Course Code	21SBBT113
Semester	1
No. of Credits	1.5 (46.8 lectures of 50 minutes)

(1.5 Credit Course)

Total Practical- 12 Practicals

Sr. No	Title of Experiment	No. of Practical
1	Biochemical calculations: Preparation of solutions and buffers, standardization of micropipettes	1
2	Working of Colorimeter & Spectrophotometer	1
3	Qualitative tests for Carbohydrates, Proteins & Lipids	2
4	Quantitative estimation of reducing sugars by DNSA method	1
5	Determination of Absorption spectra of Protein	1
6	Quantitative estimation of proteins by Biuret & Folin Lowry method	2
7	Detection of amylase in the given source using DNSA reagent	1
8	Quantitative estimation of Cholesterol	1
9	Determination of Saponification number of given lipid	1
10	Determination of Isoelectric point of glycine	1

References:

1. Practical methods in Molecular biology by Robert F. Schleif Pieter C. Wensink, Illustrated edition, Springer New York Publisher.
2. Biochemical methods by S.Sadasivam and A. Manickam, 2nd edition, New Age International (P) Ltd., Publishers



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Course/ Paper Title	Biophysical techniques
Course Code	21SBBT121
Semester	II
No. of Credits	2 (36 lectures of 50 minutes)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	To familiarize students with the Basics of Biophysical techniques
2.	To introduce the different types of biophysical techniques used in life sciences
3.	To understand the principle, working of different biophysical techniques.
4.	To understand the application of different biophysical techniques.
5.	To present to the students the importance of biophysical techniques in research and industry.

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will understand the applications of biophysical techniques in research and industry.

2.	Students will be acquainted with the principle, working of different biophysical techniques.
3.	Students will understand the Basics of Biophysical techniques.

Syllabus

Unit No.	Title with Contents	No. of Lectures
Unit I	Principle, working and applications of chromatography and centrifugation.	18
	1. Principle, Construction, Working, Calibration & applications of basic instruments – <ul style="list-style-type: none"> i. Pipettes ii. pH meter iii. Weighing Balance 	03
	2. Chromatography – <ul style="list-style-type: none"> i. Theory (Principle, Distribution co-efficient, Rf Value) ii. Thin Layer and Paper Chromatography iii. Affinity Chromatography iv. Ion-exchange Chromatography v. Gel filtration Chromatography vi. Gas Chromatography and HPLC 	10
	3. Centrifugation – <ul style="list-style-type: none"> i. Theory (RCF, Sedimentation coefficient, types of centrifuges) ii. Differential centrifugation iii. Density gradient centrifugation (Rate Zonal & Isopycnic) iv. Analytical centrifugation. 	05



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Course/ Paper Title	Applications of Statistics and Computer in biology
Course Code	21SBBT122
Semester	II
No. of Credits	2 (36 lectures of 50 minutes)

Aims & Objectives of the Course

Sr. No.	Objectives
1.	Provide understanding about the principles of biological data collection, statistical analysis and presentation.
2.	Provide a hands-on-experience by performing practicals that are well correlated with the theory topics and are designed to support skill oriented learning outcomes in the management of biological data.

Expected Course Specific Learning Outcomes

Sr. No.	Learning Outcome
1.	Understand the principles of biological data collection, statistical analysis and presentation.
2.	Apply the principles of biological data management in real life situations

3.	Learn and appreciate various factors that influence type of sample collected and sample size
4.	Collect, analyze and interpret biological data using appropriate statistical tools
5.	Improvise their computational, mathematical and computer skills, which would increase their eligibility to pursue research based higher education

Syllabus

Unit No.	Title with Contents	No. of Lectures
Unit I	Biostatistics	18
1	<p>1. Introduction to Statistics-</p> <ul style="list-style-type: none"> i. Need of Biostatistics in biology, Basic definitions, notations and applications. ii. Sampling: Representative sample, sample size, sampling techniques. Data collection and presentation, types of data, methods of collection of primary and secondary data. iii. Data presentation (Line, bar graphs and Pie diagram). <p>2. Descriptive statistics -</p> <ul style="list-style-type: none"> i. Arithmetic mean, mode median, ii. Standard deviation, Variance, mean variance <p>3. Frequency distribution-</p> <ul style="list-style-type: none"> i. Probability ii. Introduction to normal, binomial and poisson distribution. <p>4. Test of Significance -</p> <ul style="list-style-type: none"> i. Parametric test: T-Tests ii. Non-parametric test: Chi Square test <p>5. Regression -</p> <ul style="list-style-type: none"> i. Correlation-Positive and negative 	<p>5</p> <p>5</p> <p>3</p> <p>3</p> <p>2</p>
Unit II	Computer for Biologist	18

1	1. History of Computers i. Generations of computers (I, II, III, IV, V) ii. Modern Computers: The workstation, Minicomputer, Mainframe Computers, Parallel processing Computer & the Super Computer.	6
	2. Introduction to computers: i. Overview and functions of a computer system ii. Input and output devices iii. Storage devices	5
	3. Data processing & presentation i. Introduction to MS Excel & Power Point	4
	4. Internet searches i. Search engines (Google and Yahoo) ii. Concepts in text-based searching	3

References:

1. Irfan A Khan- Fundamentals of Biostatistics, Hyderabad, India : Ukaaz, 2004.
2. Campbell R.C- Statistics for Biologists, Cambridge University Press, Cambridge.
3. Wardiaw A.C - Practical statistics for experimental biologists, Wiley–Blackwell
4. Cochran W.G. and G.W- Snedeco. Statistical methods –Sixth Edition, The Iowa State University Press, Ames.
5. Orpita Bosu, Simminder Kaur Thukral - Bioinformatics Databases, Tools and Algorithms, Oxford University Press.
6. P.K. Sinha - Computer fundamentals, 4th edition BPB publication, India
7. David Mount- Bioinformatics Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press,U.S.; 2nd edition
8. Andrew S Tanenbaum- Computer Networks. 4th edition Tanenbaum. Pearson Education, India.

F.Y.B.Sc Vocational Biotechnology

(CBCS – Autonomy 21 Pattern)

Course/ Paper Title	Lab Course II: Practical in Biophysical techniques, Biostatistics & Computers
Course Code	21SBBT123
Semester	II
No. of Credits	1.5 (46.8 lectures of 50 minutes)

Sr. No.	Title of Experiment	No. of Practical
Bioinstrumentation		
1	Standardization and calibration of pH meter. Preparation of buffers and measurement of pH	2
2	Demonstration of Beer and Lambert's Law	1
3	Demonstration of working of Centrifuge	1
4	Separation and identification of plant pigments/ sugars by TLC	1
5	Separation and identification of amino acids by paper chromatography	1
6	Demonstration of working of Agarose Gel Electrophoresis	1
Biostatistics & Computers		
1	Introduction MS Excel and use of spreadsheets for data organization & applications	1
2	Internet searches : Search Engines: Google & Yahoo	1
3	Data presentation using various graphical types <ul style="list-style-type: none">• Bar Diagram• Line graph• Pie Chart	1
4	Measure of central tendency <ul style="list-style-type: none">• Mean• Median• Mode• Standard deviation and correlation	1

5	Hypothesis testing using Data Analysis Tools <ul style="list-style-type: none"> • Chi square test • t- test 	1

References :

1. Practical Use Of Biostatistics by Abhiram Behera : Author : Abhiram Behera, Edition : 1st, Publisher : Paras Medical Publisher, Year : 2016 , Pages 350

2. Practical Biostatistics : A Friendly Step-by-Step Approach for Evidence-based Medicine, 1st Edition, Authors: Mendel Suchmacher Mauro Geller , Imprint: Academic Press, Published Date: 26th July 2012, Page Count: 248

3. Biochemical methods by S.Sadasivam and A. Manickam, 2nd edition, New Age International (P) Ltd., Publishers.

4. Introduction to Experimental Biophysics: Biological Methods for Physical Scientists: by Jay L. Nadeau (Author), Volume 2 (Foundations of Biochemistry and Biophysics) Paperback – Import, 26 October 2011.