SHIVAJI UNIVERSITY, KOLHAPUR.

****

Accredited By NAAC With 'B' Grade

Revised Syllabus For

Bachelor of Science

Part - I

BIOTECHNOLOGY (OPTIONAL / VOCATIONAL)

Syllabus to be implemented from June, 2013 onwards.

Shivaji University, Kolhapur
Revised Syllabus For Bachelor of Science Part – I : Biotechnology

1. **TITLE : Biotechnology**

2. **YEAR OF IMPLEMENTATION**:- Revised Syllabus will be implemented from June, 2013 onwards.

3. **PREAMBLE:**

This syllabus is framed to give sound knowledge with understanding of Biotechnology to undergraduate students at first year of three years of B.Sc. degree course.

Students learn Biotechnology as a separate subject from B.Sc. I. The goal of the syllabus is to make the study of Biotechnology popular, interesting and encouraging to the students for higher studies including research.

The new and updated syllabus is based on a basic and applied approach with vigor and depth. At the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research.

The syllabus is prepared after discussion at length with number of faculty members of the subject and experts from industries and research fields.

The units of the syllabus are well defined, taking into consideration the level and capacity of students.

4. **GENERAL OBJECTIVES OF THE COURSE / PAPER:**

1) To make the students knowledgeable with respect to the subject and its practicable applicability.
2) To promote understanding of basic and advanced concepts in Biotechnology.
3) To expose the students to various emerging areas of Biotechnology.
4) To prepare students for further studies, helping in their bright career in the subject.
5) To expose the students to different processes used in industries and in research field.
6) To prepare the students to accept the challenges in life sciences.
7) To develop skills required in various industries, research labs and in the field of human health.

5. **DURATION**

- **The course shall be a full time course.**

6. **PATTERN:-**

Pattern of Examination will be Semester.

7. MEDIUM OF INSTRUCTION :

The medium of instruction shall be in English.

8. STRUCTURE OF COURSE-

(Note – The structure & title of papers of the degree as a whole should be submitted at the time of submission / revision of first year syllabus.

1)

FIRST SEMESTER --------- (NO.OF PAPERS 2)

Sr.No.	Subjects	Marks
1.	Paper – I	50
2.	Paper – II	50

SECOND SEMESTER--------- (NO.OF PAPERS 2)

Sr.No.	Subjects	Marks
1.	Paper – III	50
2.	Paper – IV	50
3.	Practical	50
	Total of Semester I and II	250

2) Structure and Titles of Papers of B.Sc. Course :

B.Sc. I Semester I

Paper I : Basics of Biotechnology I

Paper II : Basics of Biotechnology II

B.Sc. I Semester II

Paper III : Cell Biology and genetics

Paper IV : Microbiology

3) EQUIVALENCE IN ACCORDANCE WITH TITLES AND CONTENTS OF PAPERS- (FOR REVISED SYLLABUS)

Sr.No.	Title of Old Paper	Title of New Paper
1.	**Semester I:** **Paper I : Basics of Biotechnology** **Paper II : Mathematics, Biostatistics and Computers.**	**Semester I:** **Paper I : Basics of Biotechnology I** **Paper II : Basics of Biotechnology II**
2.	**Semester II:** **Paper III : Cell Biology and genetics** **Paper IV : Microbiology**	**Semester II:** **Paper III : Cell Biology and genetics** **Paper IV : Microbiology**
3.	**Practical – Old**	**Practical – New**

4) OTHER FEATURES :

(A) LIBRARY :

Reference and Text Books, Journals and Periodicals, Reference Books for Advanced Books for Advanced studies. – List Attached

(B) SPECIFIC EQUIPMENTS : Necessary to run the Course.

OHP, Computer, L.C.D., Projector

(C) LABORATORY SAFETY EQUIPMENTS :

1) **Fire extinguisher**

2) **First aid kit**
3) **Fumigation chamber**
4) **Stabilized power supply**
5) **Insulated wiring for electric supply.**
6) **Good valves & regulators for gas supply.**
7) **Operational manuals for instruments.**
8) **Emergency exits.**

SHIVAJI UNIVERSITY, KOLHAPUR

Revised syllabus – Introduced from June, 2013

B.Sc. Part I : Biotechnology

Paper I – (BTO – 101) – Basics of Biotechnology I

Topic No.		Lectures
1.	Unit I **Biotechnology:**- Origin & definition, history of biotechnology, biotechnology as a interdisciplinary area, scope & importance of biotechnology, branches of biotechnology, biotechnology in India, Commercial potentials of Biotechnology, Achievements of Biotechnology, Misuse of Biotechnology, Prevention of misuse of Biotechnology, Future of Biotechnology.	9
2.	Unit II **Carbohydrates:-** General classification of carbohydrates, structural classification of monosaccharides, ring formation in monosaccharides, mutarotation , oligosaccharides, formation of glycosidic bond, disaccharides (sucrose, maltose, lactose, cellobiose), polysaccharides (e.g.starch, glycogen, cellulose, heparin, pectin), biological functions of carbohydrates. Molecules involved in generation of Mechanical Stability: Peptidoglycan, Polysaccharide - Cellulose(structure) in plant.	11
3	Unit III **Proteins:-** Introduction, General structure of amino acids, Structure of peptide bond, Structural classification of amino acids based on R side chain, classification of proteins based on chemical composition, conformation(globular & fibrous) and biological functions, structural levels of proteins. **Enzymes:** Definition, Structure- Concept of apoenzyme, coenzyme, cofactor, prosthetic group and active site. Types- Extracellular , Intracellular, Endoenzymes and exoenzymes, Constitutive and Inducible.	8
4.	Unit IV **Nucleic acids:** Nucleosides, nucleotides, polynucleotide, Watson and Crick's structural model of DNA, Polymorphism of DNA helics (A, B, C, D, E, & Z), RNA: Chemical composition structure and functions of mRNA, rRNA, tRNA. Forces stabilizing nucleic acid structure. **Lipids:** Definition, Classification of fatty acids based on nature of Hydrocarbon chain – Saturated and unsaturated.Classification of lipids based on backbone structure – simple (triacylglycerols & waxes) ,compound (phospholipids, sphingolipids,cerebrosides), derived – e.g.	8

	cholesterol), Functions of lipids.	

References:

1) Text book of biotechnology- Pradip parihar student ed. Jodpur (2004)
2) Biotechnology expanding horizons- B. D. Singh, Kalyani Publisher
3) Elements of biotechnology- P. K. Gupta, Rastogi publications.
4) Biotechnology- V. Kumarsan, Saras publication.
5) A text book of biological chemistry- M. S.Yadav, Dominant publishers.
6) Outline of biochemistry- Conn & Stumph
7) Principles of Biochemistry- Jeffory, Zubey
8) Biochemistry- Lubert Stryer
9) Textbook of Biotechnology – R. C. Dubey.
10)Biochemistry by – Lehninger.
11) Biochemistry – U. Satyanarayana.
12) Biochemistry – Nelson & Cox.

Paper II - (BTO – 102) – Basics of Biotechnology II

Topic No.		Lectures
1.	**1. Microscopy :** A. General Principles of Microscopy – Image formation, Magnification, Numerical aperture (uses of oil immersion objective), Resolving power and Working distance. B. Ray diagram, special features, applications and comparative study of – i) Compound Microscope ii) Electron Microscope **Spectroscopy:-** Lambert-Beer's law principle, construction & working of colorimeter, spectrophotometer. **Physical methods to find out molecular structure :-** NMR & X-ray crystallography.	8
2.	Unit II **Biostatistics:-** **Probability:-** Random experiment, sample space, event, probability of an event, axioms of probability. **Measures of central tendencies:-** Mean, calculation of mean of ungrouped & grouped data, mode & median of ungrouped data. Measures of deviation, mean deviation & standard deviation (For ungrouped data) **Sampling:-** Types of sampling- purposive sampling, random sampling, simple sampling & stratified sampling.	9
3.	Unit III **Fundamentals of Computers:** General introduction, Organization of computers, digital & analogue computers. **Office Operation**: **Microsoft Word-** Concept of word, concept of toolbar, character, paragraph & document formatting, drawing toolbar, Header, Footer, Document editing, Page setup, short cut Keys, Text and graphics **Microsoft Excel-**Concept of spreadsheet, Creating worksheet, Well formatted documents, concept of row, column, cell and formula bar, using function, using shortcuts, charts, conditional formatting **PowerPoint-**Slide presentation, slide layout, Design, custom animation.	10
4.	Unit IV **Basics of Bioinformatics:** Internet, world wide web, web browser, search engine (Google), searching data from search engine. **Bioinformatics-**Introduction, Nature of Biological data, characteristics of data, Tools for Protein function analysis, Homology and similarity, structure analysis, sequence analysis, BLAST, FASTA, EMBOSS, Clustalw , Applications.	9

Reference Books:

1. Biophysics- Pattabhi & Gautam - Narosa publishing house.
2. Principles and techniques of Molecular biology – Wilson and Walker.
3. Biophysics – Nath Upadhay.
4. Introduction of Biostatistics – Pranab Kumar Banerjee - S. Chand publications
5. Computer Fundamentals by P. K. Sinha
6. Use of Computer from Vision Publication.
7. Computer Fundamentals – P. K. Sinha
8. Computer fundamentals – Rajaraman
9. Windows reference book- Microsoft
10. Introduction to bioinformatics- T.K. Attwood.
11. Bioinformatics- A Beginner's guide- Jean Michel Claverie
12. Bioinformatics – Rastogi.

BTO 201 – Paper III
Cell Biology and Genetics.

Topic No.		Lectures
1.	Unit I **History of cell biology:-** Cell biology before 19th century, cell biology in 19th century- formulation cell theory, protoplasm theory, germplasm theory, cell biology in 20th century- organismal theory, Branches of Cell Biology, Scope of cell biology. **Cell types:-** Prokaryotic & eukaryotic cells. **Cell division & cell cycle:-** Cell cycle, Phases of cell cycle, Mitosis, Meiosis	9
2.	Unit II **Structure & Function of cell organelles:-** Ultra structure of cell membrane, Cytosoles, Golgibodies, Endoplasmic reticulum (Rough & smooth), Ribosomes, Cytoskeleton: structure (Actin, microtubules), Mitochndria, Chloroplast, Lysosomes, Peroxisomes, Nucleus.	9
3.	Unit III **Chromosomes**:- chemical composition, structural organization of chromatids, centromeres, telomeres, chromatin, nucleosome organization, eu & heterochromatin, special chromosomes (e.g. polytene & lampbrush chromosomes) banding pattern in human chromosomes. Extrachromosomal inheritance- Mitochondrial & Chloroplast genetic systems. **Plasmid:** Types, structure, properties, and applications.	9
4.	Unit IV **Basic concepts:** Gene, Genome, Genotype, Phenotype, Cistron, Muton, Recon, Operon, split genes, concept of genetic code. **Mutagen:** Definition, examples of chemical & physical mutagens. **Mutation:** Definition, Types of mutation - Spontaneous & induced, chemical basis- base substitution, insertion, deletion mutations. Mechanism of induced mutagenesis by – UV light, 5-Bromouracil.	9

Reference books:-

1. Cell and molecular biology- Arumugham
2. Cell and molecular biology- De Robertis
3. Cytology genetics and evolution- Agrwal and varma
4. Cell biology- C. B. Pawar
5. Fundamentals of microbiology- Frobisher
6. Microbiology-Pelczar.
7. General microbiology- Stanier.
8. Text book of microbiology- Ananthnarayan
9. Gene- Benjamini Lewin.
10. Genetics. Strickberger M.W.

11. Genetics - Goodenough U.
12. Genes IV- Lewin B.

BTO 202 –Paper IV
Microbiology

Topic No.		Lectures
1.	Unit I **Microbiology :** Definition, History, Introduction to types of Microorganisms – Bacteria, Algae, Fungi, Protozoa and Viruses, Beneficial and harmful activities of microorganisms, Applied branches of Microbiology **Morphology and cytology of Bacteria** A. Morphology of Bacteria – i) Size, ii) Shape, iii) Arrangements B. Cytology of Bacteria – a) Structure and functions of : i) Cell wall ii) Cell membrane iii) Capsule and slime layer iv) Flagella v) Pili vi) Nuclear material vii) Mesosome viii) Ribosome	9
2.	Unit II **Bacterial taxonomy:** 1. General principles of bacterial nomenclature.- a) Taxonomic ranks b) Common or Vernacular name c) Scientific or International name 2. Criteria for bacterial classification- Morphological, cultural, biochemical & serological characters. 3. Concept of bacterial species & strain. **Culture media-** Definition of culture media, Common components of media and their functions- Peptone, Yeast extract, NaCl, Agar and Sugar, Types: non living media- natural, synthetic, semi-synthetic & differential, enriched, enrichment & selective, living media. **Methods for isolation of pure cultures:-** Streak plate, pour plate, spreading plate.	10
3.	Unit III **Concept of Sterilization:-** Methods of sterilization- **a) Physical agents:** i) temperature-dry heat, moist heat ii) Radiation- U.V, Gamma radiation iii) Bacteria proof filter- membrane filter. **b) Chemical agents:-** Phenol & Phenolic compounds, Alcohol, Heavy metals(e.g. mercury). **c) Gaseous agents-** Ethylene oxide, formaldehyde. **Stains and staining procedures -**	9

	A. Definition of dye and stain B. Classification of stains – Acidic, Basic and Neutral C. Principles, Procedure, Mechanism and application of staining procedures i) Simple staining ii) Negative staining iii) Differential staining : Gram staining and Acid fast staining	
4.	Unit IV **Microbial nutrition** A. Microbial Nutrition 1) Nutritional requirements of microorganisms : Water; Micronutrients; Macronutrients; Carbon, Energy source; Oxygen and Hydrogen; Nitrogen, Sulphur and Phosphorous and growth factors-auxotroph, prototroph and fastidious organisms. 2) Nutritional types of microorganism based on carbon and energy sources. Autotrophs- Photoautotrophs and Chemoautorphs, Heterotrophs- Photoheterotrophs and Chemoheterotrophs.	8

Reference Books:

1) Microbiology by Pelczar, M.J.Jr., Chan E.C.S., Krieq, N.R. 5th edition,1986 (McGraw Hills Publication).
2) Fundamental Principles of bacteriology by A. J. Salle, Tata McGraw Hill.
3) Fundamentals of Microbiology – by Frobisher, Hindsdill, Crabtree, Good Heart, W.B. Saunders Company, 7th edition.
4) General microbiology- Stanier.
5) Text book of microbiology- Ananthnarayan
6) Elementary Microbiology Vol. I by Dr. H.A.Modi , Akta Prakashan, Nadiad, Gujrat.

BTO 2O3- Laboratory Exercises in Basic Biotechnology

Sr. No.	Name of the Practical
	(Microbiological Techniques)
1.	**Use, care and study of compound Microscope.**
2.	Demonstration of some laboratory equipments:- Autoclave, hot-air oven, incubator, laminar air flow, centrifuge, Colorimeter, Water bath, colony counter, Distilled water plant.
3.	**Microscopic examination of Bacteria** i) Monochrome staining ii) Negative staining iii) Gram staining iv) Hanging drop technique of motility
4.	**Preparation of culture media –** i) Peptone water ii) Nutrient broth iii) Nutrient agar iv) MacConkey's agar v) Sabouraud's agar vi) Starch agar vii) Milk agar
5.	Isolation, Colony characteristics, Gram staining and motility of bacteria isolated from air(Solid impingment technique), Water and soil (dilution and spreading plate technique)
6.	Enumeration of microorganisms by total viable count from soil.
7.	Isolation & cultivation of yeast and molds(Penicillium, Aspergillus)
	Biochemical techniques
1.	Estimation of sugar by DNSA method
2.	Estimation of amino acids by Ninhydrin method.
3.	Estimation of Proteins by Biuret method.
4.	Estimation of DNA by Diphenyl amine method
5.	Estimation of RNA by Orcinol method.
6.	Separation and identification of amino acids by paper chromatography.
7.	Isolation and characterization of Casein from milk.
8.	Study of Lambert Beer's law by Copper sulphate method.
9.	Biostatistics (Measures of central tendencies)
10.	Computer practicals in MS – Word (Writing a sentence and formatting it, saving a document)
11.	Computer practicals in MS – PowerPoint. (Preparation of slide, custom animation and slide show)

Books recommended for Practicals

1) Stains and Staining procedures by Desai and Desai.
2) Introduction to Practical Biochemistry by D. Plummer, J Wiley and Sons.
3) Bacteriological techniques by F. J. Baker.
4) Introduction to Microbial techniques by Gunasekaran.
5) Biochemical methods by Sadashivan and D. Manickam.
6) Laboratory methods in Biochemistry by J. Jayaraman.
7) Experimental Microbiology – Patel & Patel

List of minimum equipments

1)	Hot air oven	-	1
2)	Incubator	-	1
3)	Autoclave	-	1
4)	Refrigerator	-	1
5)	Medical microscopes	-	10 nos. for one batch
6)	Chemical balance	-	2
7)	pH meter	-	1
8)	Centrifuge	-	1
9)	Colorimeter	-	1
10)	Distilled Water Plant	-	1
11)	Laminar air flow cabinet	-	1
12)	Colony counter	-	1
13)	Water bath	-	1

14) Arrangements for gas supply and fitting of two burners per table.
15) One working table of 6’ x 2½’ for two students.
16) One separate sterilization room attach to the laboratory (10’ x 15’)
17) At least one wash basin for a group of five students
18) One separate instrument room attached to lab (10’ x 15’)

19) One laboratory for one batch including working tables (6' x 2½') per two students for one batch

20) Store room (10' x 15')

Practical Examination

(A) The practical examination will be conducted on two consecutive days for three hours per day per batch of the practical examination.

(B) Each candidate must produce a certificate from the Head of the Department in her/his college, stating that he/she has completed in a satisfactory manner the practical course on lines laid down from time to time by Academic Council on the recommendations of Board of Studies and that the journal has been properly maintained. Every candidate must have recorded his/her observations in the laboratory journal and have written a report on each exercise performed. Every journal is to be checked and signed periodically by a member of teaching staff and certified by the Head of the Department at the end of the year. Candidates must produce their journals at the time of practical examinations.

Nature of question paper and distribution of marks for Practical Examination

Distribution of Marks for Practical Exam:-

1. BTO 103: Biochemical Techniques:-	
One major experiment	10 marks
One minor experiment	05 marks
2. BTO 203: Microbiological Techniques:-	
One major experiment	10 marks
One minor experiment	05 marks
3. Practical on biophysics (Study of Lambert-Beer's law)	10 Marks
OR	
Practical on Biostatistics	
OR	
Practical on Computer	
4. Oral on Practicals	05 marks
5. Journal	05 marks
Total Marks	**50**

Nature of question paper and distribution of marks for Theory Examination

Q.1	Objective type	10
	(The multiple choice – 10 questions)	
Q.2	Attempt Any Two	20
	(A) Descriptive question	
	(B) Descriptive question	
	(C) Descriptive question	
Q.3	Attempt Any 4 out of 6 (Short Notes / Answers)	20

		50

****