**“Education for Knowledge, Science and Culture”**
**-Dr. Bapuji Salunkhe**

**Shri Swami Vivekanand Shikshan Sanstha’s**

**Vivekanand College, Kolhapur(Autonomus)**

# Syllabus implemented fr B.Sc. Part-I Biotechnology (Optional) Semester I & II From September 2021 onwerds

| Sr. No. | Semester | Paper | Name Of Paper | Total Marks |
|---|---|---|---|---|
| 1 | Semester I | Paper I | Basics of Biotechnology I | 100 |
| | | Paper II | Basics of Biotechnology II | |
| 2 | Semester II | Paper III | Microbiology | 100 |
| | | Paper IV | Basics Cell biology and genetics | |

# CBCS Syllabus to be implemented from September 2021 onwards

| Course Offered B.Sc I Semester I & II | Name of Subject | Course Outcome |
|---|---|---|
| Paper I | Basics of Biotechnology l | At the end of this course students will able to;<br>CO 1: Describe various proteins w.r.t. their structural level.<br>CO 2: Classify types of vitamins & able to state their deficiency syndromes.<br>CO 3: Specify types of Diabetes & can counsel remedies.<br>CO 4: Outline types & uses of Sugars & Lipids. |
| Paper II | Basics of Biotechnology ll | .At the end of this course students will able to;<br>CO 1: Isolate & purify particular protein.<br>CO 2: Explain the principle of centrifugation.<br>CO 3: Understand the working of Microscope.<br>CO 4: Discuss the instrumentation & working of UV visible spectroscopy. |
| Paper III | Microbiology | At the end of this course students will able to;<br>CO 1: Elucidate the harmful activities of bacteria.<br>CO 2: Design media to culture specific bacterial strain.<br>CO 3: Conclude importance of sterilization<br>CO 4: Compare various types of staining. |
| Paper IV | Basics of Cell biology and genetics | At the end of this course students will able to;<br>CO 1: List various cell organelles with functions.<br>CO 2: Differentiate Prokaryotic & Eukaryotic cells.<br>CO 3: Elaborate the Mendelian Genetics.<br>CO 4: Predict how crossing over helps in species diversity & evolution |

# Vivekanand College Kolhapur, (Autonomous),

## CHOICE BASED CREDIT SYSTEM SYLLABUS

## ForBachelor of SciencePart - I

## BIOTECHNOLOGY (Optional)

### Introduction

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 thesyllabus is to make the study of Biotechnology popular, interesting and encouraging to the studentsfor 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 ofother universities and the needs of industries and research.

The syllabus is prepared after discussion at length with number of faculty members ofthe subject and experts from industries and research fields. The units of the syllabus are well defined, taking into consideration the level andcapacity of students.

## Objectives :-

1) To make the students knowledgeable with respect to the subject and its practicableApplicability.Due to which student become familiar with different techniques in biotechnology at under graduate level

2) To promote understanding of basic and advanced concepts in Biotechnology.

3) To expose the students to various emerging areas of Biotechnology,(Medical 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.

| | Semester I- Paper I- Basics of Biotechnology I | |
|---|---|---|
| | **UNIT I** | **Lectures (30)** |
| 1 | **Biotechnology:** definition, history, Branches, scope<br>**Amino acids and Protein :-**Introduction, General structure of amino acids, Structural classification of amino acids based on R side chain, single letter code, Reaction of amino acids ,Structure of peptide bond, biological functions of protein , structural levels of protein- Primary, Secondary, Tertiary (Myoglobin), Quaternary ( Hemoglobin)<br><br>**Vitamins**- Introduction, Types , Roles, Deficiency | **15** |
| | **UNIT II** | |
| 2 | **Carbohydrate**: **:-** General classification of carbohydrates, ring formation in monosaccharide, mutarotation , formation of glycosidic bond, study with respect to structure ,chemical properties, hydrolysis of disaccharides ( e.g. sucrose, maltose ,lactose, ),oligosaccharides, polysaccharides ( e.g. starch, glycogen, Cellulose) biological functions of carbohydrates.<br>**Diabetes militias causes ,type, remedies**<br><br>**Lipid :-** Definition, **Fatty Acids , types,**<br>Classification of lipids-<br>Simple lipid- (triacylglycerols & waxes)<br>Compound lipid- ( phospholipids, sphingolipids, cerebrosides, Lipoproteins),<br>Derived lipid – e.g. cholesterol<br>Properties of lipid.<br>Functions of Lipids. | **15** |

| | Paper II Basisc of Biotechnology II | |
|---|---|---|
| | **Unit I** | **Lectures(30)** |
| | **Protein Purification**: Method of cell disruption (Blenders, grinding with abrasives, presses, enzymatic method, sonication ); Salt participation- Salting in, salting out, organic solvent precipitation, dialysis, ultra filtration.<br><br>**Centrifugation**- Basic principles, RCF, Sedimentation coefficient, Svedberg's constant, Types of centrifuge: Desktop, High speed and Ultracentrifuge, Preparative centrifugation: Differential and density gradient centrifugation | **15** |
| | **Unit II** | |
| | **Microscopy:** a) General principles of microscopy- Image formation, magnification, numerical aperture, resolving power of microscope and working distance. b) Ray diagram, special features, applications and comparative study of compound microscope and Electron Microscope (Scanning and Transmission Electron Microscope).<br><br>**UV-Visible Spectroscopy and Colorimetry-**<br><br>Introduction to spectroscopy, properties of electromagnetic radiation (UV and Visible range, Electromagnetic spectrum, Electronic Transitions,<br><br>Principle, Instrumentation with respect to colorimeter and single beam spectrophotometer. Principle, Instrumentation, Applications of UV and Visible spectrophotometer and colorimeter Lambert-Beer's law,<br><br>**A. Concept of Sterilization:-** Methods of sterilization<br><br>**a)Physical agents:** i) temperature-dry heat, moist heat ii) | **15** |

| | | |
|---|---|---|
| | Radiation-<br>U.V, Gamma radiation iii) filters- membrane filter.<br>**b) Chemical agents:-** Phenol & Phenolic compounds, Alcohol,<br>Heavy metals (e.g. mercury).<br>**c) Gaseous agents-** Ethylene oxide, formaldehyde. | |

Reference Books :-


1. Text book of biotechnology- Pradip parihar student ed. Jodpur (2004)

2. Biotechnology expanding horizons- B. D. Singh, Kalyani Publishe

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

10. Biochemistry – U. Satyanarayana

11.Biochemistry –Glick & Pasterneck

12.Practical Biochemistry principles and techniques – Willson and Walker

13.Protein purification by Robert Scope

14.Biophysical chemistry- Nath Upadhyay

| | Semester II- Paper III-Microbiology | |
|---|---|---|
| | **Unit I** | **Lectures(30)** |
| | **History of Microbiology :-** Contributions of Anton van Leeuwenhoek, Alexander Fleming, Louis Pasteur, Robert Koch, Joseph Lister.<br>Introduction to types of Microorganisms – Bacteria, Algae, Fungi, Protozoa and Viruses,<br>Beneficial and harmful activities of microorganisms, Applied Branches of Microbiology<br>**Morphology and cytology of Bacteria**<br>A. Morphology of Bacteria – i) Size, ii) Shape, iii)Arrangements<br>B. Cytology of Bacteria – Structure of Typical Bacterial Cell.<br>a) **Structure and functions of :Bacterial cell parts**<br>i) Cell wall ii) Cell membrane iii) Capsule and slime layer iv)Flagella v) Pilli vi) Nuclear material vii) Mesosome viii)Ribosome | **15** |
| | **Unit II** | |
| | **A.Culture media and pure culture techniques:** Common components of media and their functions Peptone, Yeast extract, NaCl, Agar and Sugar<br><br>**B. Culture media - a**) Living Media (Lab. animals, plants, bacteria, embryonated eggs, tissue cultures), b) Non living media – i)Natural, ii) Synthetic, iii) Semi synthetic, iv)Differential, v) Enriched,vi) Enrichment, vii) Selective.<br>**C. Methods for isolation of pure cultures**- Streak plate, pour plate, spread plate.<br>**D. Stains and staining procedures -**<br>a. Definition of dye and stain<br>b. Classification of stains – Acidic, Basic and Neutral<br>d .Principle, Procedure, Mechanism and application of staining procedures<br>i) Simple staining<br>ii) Negative staining<br>iii) Differential staining: Gram staining and Acid fast staining | **15** |

| | Paper II-Basics in Cell biology & Genetics | |
|---|---|---|
| | **Unit I** | **Lectures(30)** |
| 1 | **History of Cell biology :-**<br>Introduction of cell and concept of prokaryotic and Eukaryotic cell.<br>Cell biology before 19th century, cell biology in19th century, formulation of cell theory, protoplasm theory, germplasm theory,<br>cell biology in 20th century- organismal theory, Branches of<br>Cell Biology.<br>**Structure and function of Cell organelles**- ultra structure and function of cell membrane, golgibodies, Endoplasmic reticulum (rough & smooth ) Ribosome, cytoskeleton structure( actin, microtubules),Mitochondria, chloroplast, Lysosomes, peroxisomes, Nucleus.<br>Cell division and cell cycle- phases of cell cycle, Mitosis.Meosis | **15** |
| | **UNIT II** | |
| | **Mendels law of Inheritance** – principal of segregation, Independent assortment, Dominance, Mendelian genetics in humans.<br>**Varity of gene expression** – modifiers, suppressors, pleiotropic gene, multiple allele.<br>Interaction of gene- Epstasis, complimentary gene, duplicate gene.<br>**Linkage** | **15** |

| | | |
|---|---|---|
| | definition, coupling and repulsion hypothesis, linkage groups.<br>Crossing over –Mechanism and theory.<br>Structural and numerical changes in chromosomes.<br>Extra chromosomal inheritance-mitochondrial and plastids. | |

Reference Books-


1. Fundamentals of Microbiology- Frobisher
2. Microbiology-Pelczar.
3. General Microbiology- Stanier.
4. Text book of Microbiology- Ananthnarayan & Panikar.
5. Cell and molecular biology- Arumugham

6.Cell and molecular biology- De Robertis

7. Cytology genetics and evolution- Agrwal and Varma

8.Cell biology- C. B. Pawar

9.Cell- Cooper.

10.Cell biology- Gilard Karp

11. Biology of Microorganisms- Brock

12.Cellbiology – Albert Brown

## Practical syllabus

### (Practical Examination to be conducted annually)

### Lab.Exercises in Basics of Biotechnology Credit -1

| S N | Title | Hr. Allotted |
|---|---|---|
| 1<br><br>1 | Preparation of Molar and Normal solutions<br>Molar solution of Sucrose.<br>Normal solutions<br>Molar solution of alkali-NaOH and Acid HCL<br>Preparation of Buffers | |
| 2 | Isolation of casein from milk | |
| 3 | Study of Lamberts Beer's Law by copper sulphate method. | |
| 4 | Estimation of glucose by DNSA method (Graphical) | |
| 5 | Isolation of starch from potato | |
| 6 | Determination of acid value of given fat | |
| 7 | Estimation of DNA by Diphenylamine method ( by calculation) | |
| 8 | Estimation of RNA by Orcinol method ( By calculation) | |
| 9 | Estimation of reducing sugar by Benedict's method | |
| 10 | Identification of given amino acid by paper chromatography | |
| 11 | Estimation of protein by Biuret method (Calculation) | |
| | Lab.Exercises in cell biology and Microbiology | |
| 1 | Use, care and study of Compound Microscope | |
| 2 | . Preparation of Culture media<br>-Peptone water,Nutrient broth and Nutrient Agar<br>-MacConkey's Agar ,Sabroud's Agar Starch Agar ,Milk Agar | |
| 3 | Microscopic Examination of Bacteria<br>1. Monochrome staining<br>2. Negative Staining<br>3. Gram's Staining<br>Hanging drop technique- Motility. | |
| 4 | Isolation, colony characters ,Gram's staining and motility of | |

| | | |
|---|---|---|
| | Bacteria isolated from-<br>- Air-( solid impaction technique)<br>Water- (dilution and spreading plate technique.) | |
| 5 | Enumeration of Bacteria from soil by total viable count- Pour plate technique. | |
| 6 | Mounting and identification of mould- *Penicillium, Aspergillus* | |
| 7. | Demonstration of some lab equipments:- Autoclave, Hot air Oven, Incubator, LAF, Centrifuge, Colorimeter, Water bath, Colony Counter, Water distillation unit | |
| 8 | Sums of Medellin genetics | |
| 9 | Study of mitosis | |
| 10 | Isolation of chloroplast | |
| 11 | Study of effect of organic solvent and temperature membrane permeability | |
| | | |

Books recommended for Practical


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) Digital weighing balance - 1

7) Digital 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.

(B) Each candidate must produce a certificate from the Head of the Department in her/his college, stating that he/she has completed satisfactory practical course online laid down from Academic Council on the recommendations ofBoard of Studies and that the journal has been properly maintained. Every candidatemust have recorded his/her observations in the laboratory journal and have written areport 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 Departmentat the end of the year. Candidates must produce their journals at the time of practicalexaminations.

Note:- At least 80% Practical should be covered in practical examination.

**Nature of Question paper and distribution of marks for Practical Examination**

| | |
|---|---|
| **Q.1 One major practical (Biochemistry)** | **10M** |
| **Q.2 One Miner Practical (Biochemistry)** | **05 M** |
| **Q.3 One major practical (Cell biology and Microbiology)** | **10M** |
| **Q.4One Miner Practical (Cell biology and Microbiology)** | **05 M** |
| **Q.5 Spotting** | **10M** |
| **Q.6 Journal** | **10M** |

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# Vivekanand College Kolhapur, (Autonomous).

**New course structure to be implemented after sanction(Draft)**

**For B.Sc-I Biotechnology-Optional**

| Sr. No. | **Internal Examination DSC Course** | | | | Total (a+b+c+d) | Conversion of 80 marks in **Total(I)** **(e)** | **SEE (Semester End Examination) DSC Course** | | **Total (II)** (f+g)= **h** | **Total (I and II)** (e+h) = **i** |
|---|---|---|---|---|---|---|---|---|---|---|
| | Paper-I (Two tests each of 10 marks) (a) | Paper-II (Two tests each of 10 marks) (b) | Home assignment Paper I (c) | Home assignment Paper II (d) | | | Paper-I (f) | Paper-II (g) | | |
| 1 | 20 | 20 | 20 | 20 | 80 | **20** | 40 | 40 | **80** | **100** |

**Nature of Internal and SEE(Semester End Examination)Examination**

1) For internal examination, there shall be two tests (online/offline) of ten marks and one home assignment of 20 marks for each paper per semester.

2) For internal examination there shall be conversion of 80 marks in 20 marks and for passing 7 marks is required out of 20.

3) For SEE (Semester End Examination), there shall be two papers (Paper I and Paper II) of each DSC course per semester, each of 40 marks.

4) There shall be combined passing for SEE (Semester End Examination) of Paper-I and Paper -II i.e 28 marks is required out of 80.

4) There shall be separate passing is mandatory for both internal and SEE (Semester End Examination).

**Practical Examination B.Sc.I ( as per BoS guidelines)**

| Sr.No. | Lab work | Journal (Punctuality, Neatness) | Attendance, and participation in the practical's, motivation | Total |
|---|---|---|---|---|
| 1 | 40 | 5 | 5 | 50 |

## Semester: I -Theory Paper Nature(Except English)

## Paper- I

**Time : 2 hours** **Total Marks: (40)**

**Instructions**: (1) **All** questions are **compulsory**.
(2) Figures to the **right** indicate **full** marks.
(3) Draw **neat** labeled diagrams **wherever** necessary.
(Paper setter may add or delete any instruction if required)

**Q.1**. **Select correct alternative**. **(8)**

(i)----------
a) b) c) d)
(ii)----------
a) b) c) d)
(iii)----------
a) b) c) d)
(iv)----------
a) b) c) d)

(v)----------
a) b) c) d)
(vi)----------
a) b) c) d)
(vii)----------
a) b) c) d)
(viii)----------
a) b) c) d)

**Q. 2. Attempt any two** **(16)**

(i)
(ii)
(iii)

**Q.3. Attempt any four** **(16)**

(i)
(ii)

(iii)
(iv)
(v)
(vi)

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**Nature of Question Paper (Except English)**

## Semester: I

## Paper- II

**Time : 2 hours** **Total Marks: (40)**

**Instructions**: (1) **All** questions are **compulsory**.
(2) Figures to the **right** indicate **full** marks.
(3) Draw **neat** labeled diagrams **wherever** necessary.
(Paper setter may add or delete any instruction if required)

**Q.1**. **Select correct alternative**. **(8)**

(i)----------
a) b) c) d)
(ii)----------
a) b) c) d)
(iii)----------
a) b) c) d)
(iv)----------
a) b) c) d)

(v)----------
a) b) c) d)
(vi)----------
a) b) c) d)
(vii)----------
a) b) c) d)
(viii)----------
a) b) c) d)

**Q. 2. Attempt any two** **(16)**

(i)
(ii)
(iii)