



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

T.Y.B.Sc. Biotechnology (Minor), Sem V

Offered as	Minor
Course/Paper Title	Cell biology and microbial genetics
Course Code	23SBBT51MN
Semester	V
No. of Credits	2
Total Teaching Hours	30

Course Objectives

1.	To provide a platform for study of different concepts in genetics.
2.	To introduce the concepts of membrane transport and cell signaling.
3.	To highlight the functions of sub-cellular organelles in the cellular activities.
4.	To help students understand different types of operons.

Course Outcome

1.	Students will understand the role of tumor suppressor genes and proto-oncogenes in oncology.
2.	Students will be familiar with the knowledge of microbial genetics and different mechanisms of gene transfer.
3.	Students will know the importance of sub-cellular organelles in cellular activities.

Syllabus

Unit	Title and Contents	Total Hours
Unit I	Cell Biology	23
1.	Structure and functions of cell organelles i. Golgi Complexes ii. Endoplasmic Reticulum iii. Lysosomes iv. Nucleus v. Mitochondria vi. Chloroplast	06
2.	Cell membrane i. Components: Lipids And Proteins ii. Fluid Mosaic Model	02
3.	Introduction to Cell signaling	01
4.	Neoplasia & Apoptosis: Intrinsic & Extrinsic pathway	01

5.	Cell junctions Cell Junction Molecules i. Selectins ii. Cadherins iii. Integrins iv. Immunoglobulin superfamily Types of cell junctions i. Adherent ii. Tight junctions iii. Gap Junctions iv. Desmosomes v. Hemidesmosomes vi. Plasmodesmata	05
6.	Oncology i. Introduction ii. Oncogenes iii. Tumor suppressor genes iv. Cancer and cell cycle	05
7.	Concept of Operons i. Lac operon iv. Arabinose	03
Unit II	Microbial Genetics	07
8.	Recombination i. Definition of recombination ii. Types of recombination iii. Homologous recombination (Holliday model)	04
9.	Transposons: i. IS elements ii. DNA transposons iii. Retrotransposons	03

References

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, *Molecular biology of the Cell*, WW Norton & Co, ISBN-13 : 978-0393884852, 7th Edition, July 2022 .
2. Lodish, Harvey; Berk, Arnold; Matsudaira, Paul; Kaiser, *Molecular Cell Biology*, W.H.Freeman & Co Ltd, ISBN-13 : 978-0716743668, 5th revised Edition, August 2003.
3. Roger Y Stainer, John L Ingraham , Mark L Wheelis, Page R Painter, Author - Roger Y Stainer, *General Microbiology*, Palgrave Macmillan, ISBN-13 : 978-0333763643, 5th edition, June 1999.
4. Gerald Carp, *Cell biology*, Wiley Publishers, ISBN-13 : 978-1118318744, 7th edition, May 2013.

E- Resources

1. <https://link.springer.com/article/10.1007/s00018-009-0114-3>
2. <https://pubmed.ncbi.nlm.nih.gov/33109539/>
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2117903/>
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6651758/>
5. <https://www.sciencedirect.com/topics/neuroscience/cell-signaling>

T.Y.B.Sc. Biotechnology (Minor), Sem V

Offered as	Minor
Course/Paper Title	Practicals in cell biology
Course Code	23SBBT52MN
Semester	V
No. of Credits	2
Total Teaching Hours	60

Course Objectives	
•	To introduce students to the basic techniques in cell biology.
•	To understand the applications of these techniques in life sciences.
•	To provide knowledge of performing these techniques in laboratory so as the students will become aware to interpret the results of the analysis under study.

Course Outcome	
•	Students will also get basic knowledge of differential centrifugation.
•	Students will become familiar with the methods of isolating sub-cellular organelles from various sources or samples.
•	Students will be able to apply these techniques in various fields of life sciences.

Syllabus		
Sr No	Title and Contents	Total Practicals
1	Isolation of Nuclei from plant cell by differential centrifugation and its confirmation by aceto-carmine staining method.	2
2	Isolation of Mitochondria from plant cell by differential centrifugation and its confirmation by succinate dehydrogenase assay.	2
3	Isolation of Chloroplast from plant cell by differential centrifugation and its confirmation by UV-Visible spectroscopy.	2
4	Isolation of lysosome by differential centrifugation and its confirmation by acid phosphatase assay.	2
5	Study of RBC membrane fragility.	2
6	Study of osmosis	1
7	Study of stage micrometry by using pollen grain/ yeast cell sample.	1

References books:

1. S.Sadasivam and A. Manickam, *Biochemical methods*, New Age International Publisher, ISBN-13 : 978-9393159656, 4th edition, July 2022.
2. S. Kannan, N. Kayalvizhi, *Cell and molecular biology (A Practical Approach)*, MJP Publishers, ISBN: 9789355270313, 1st edition 2023.
3. Dr. Renu Gupta, Dr. Seema Makhija, Dr. Ravi Toteja, *Cell Biology: Practical Manual*, Prestige Publishers, ISBN-13 : 978-8193651216, January 2018.
4. Julio E. Celis, *Cell Biology: A Laboratory Handbook*, Academic Press, ISBN-13 : 978 0121647162, January 1997.

E- Resources:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10093037/>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8530414/>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8108496/>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5473068/>

T.Y.B.Sc. Biotechnology Sem V

Offered as	Minor
Course/Paper Title	Bioinstrumentation techniques
Course Code	23SBBT51VS
Semester	V
No. of Credits	2
Total Teaching Hours	60

Course Objectives	
•	To introduce students to the basic techniques used in the field of life sciences
•	To understand the working and principle of different bioinstrumentation techniques.
•	To provide knowledge of applications of these techniques in research and industry.

Course Outcome	
•	Students will also get basic knowledge of different bioinstrumentation techniques.
•	Students will become familiar with the principle and working of these techniques in research and industry
•	Students will be able to apply these techniques in various fields of life sciences and in research.

Syllabus		
Sr. No	Title and Contents	Total Practicals
1	Principle, working and analysis of sample by flash chromatography.	3
2	Principle, working and analysis of sample by infrared spectroscopy	1
3	Principle, working and analysis of sample by gas chromatography	2
4	Principle, working and analysis of sample by HPLC	1
5	Principle, working and analysis of sample by thermo gravimetric analysis.	1
6	Principle, working and analysis of sample by spectro-fluorometer.	3
7	Principle, working and analysis of sample by UV spectrophotometer	1

References books:

1. Khandpur, *Handbook of Biomedical Instrumentation*, McGraw Hill; Standard Edition (31 January 2024); McGraw Hill Education (India) Private Limited, ISBN-13 : 978-9355328021, 3rd edition, January 2024.
2. S.Sadasivam and A. Manickam, *Biochemical methods*, New Age International Publisher, ISBN-13 : 978-9393159656, 4th edition, July 2022.
3. Prakash M, *Understanding Bioinstrumentation*, Discovery Publishing House, ISBN: 9788183564793, 9788183564793. 1st edition, April 2009.
4. Jay L. Nadeau , *Introduction to Experimental Biophysics: Biological Methods for Physical Scientists: Volume 2 (Foundations of Biochemistry and Biophysics)*, CRC Press, ISBN-13 : 978-1439829530, 1st edition , 26 October 2011.

E- Resources

1. <https://doi.org/10.1080/10408347.2020.1777522>
2. <https://www.advancechemjournal.com/articles/aac-aid1026.pdf>
3. <https://pubmed.ncbi.nlm.nih.gov/27727137/>
4. <https://pubmed.ncbi.nlm.nih.gov/21546661/>



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

Program Objectives and outcomes:

Program objectives:

- 1) To give exposure to the students of non-science background to understand the field of biology.
- 2) To develop the idea of applying or interconnecting the basic knowledge of biotechnology with various fields of commerce.
- 3) To inculcate the knowledge of biology in students.
- 4) To make students understand the applications of biotechnology, in the field of research, industry and day to day life.

Course structure

Semester	Paper code	Paper Title	Number of credits	Number of lectures
III	23SBBT31OE	Introduction to Biotechnology and its applications	2	30
I	23SBBT11OE	Biotechnology- Introduction and its applications	2	30



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

F.Y.B.Sc. Biotechnology (NEP 2023 Pattern)

Course/ Paper Title	Introduction to Biotechnology and its applications
Course Code	23SBBT31OE
Semester	III
No. of Credits	2

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.
4.	Students will understand the process of production of bio-based products like cheese and wine in industry.

Syllabus

Unit No	Title and Contents	No of lectures
Credit I	Introduction to Biotechnology	15
Chapter 1	What is Biotechnology? Introduction, Milestones in the History of Biotechnology, Biotechnology in day to day life.	4
Chapter 2	Branches of Biotechnology and their applications in the field of life sciences: Gold biotechnology, Blue biotechnology, Green biotechnology, Red biotechnology, White biotechnology, Yellow biotechnology, Grey biotechnology, Brown biotechnology, Violet biotechnology, Dark biotechnology.	8
Chapter 3	Medical Biotechnology- Antibiotics and bio-based kits	3

Credit II	Applications of Biotechnology	15
Chapter 4	Industrial set-up: A basic layout of set-up of an industry, its parts and functions.	4
Chapter 5	Biotechnology in food and dairy- Prebiotics, Probiotics, Functional foods, Nutraceuticals and their applications in human welfare.	7
Chapter 6	Applications of Biotechnology in solving environmental problems- Bioremediation and waste water treatment.	4

References:

1. William Bains- Biotechnology from A to Z, OUP Oxford; 3rd edition (12 March 2004), ISBN-13 : 978-0198524984.
2. Purohit, Biotechnology: Fundamentals and application, Agrobios (India) (January, ISBN- : 978-8177541397
3. A. Whitaker- Principles of Fermentation Technology, 2nd edition, Butterworth-Heinemann Ltd, ISBN-13 : 978-0750645010
4. L.E.J.R. Casida- Industrial microbiology, 2nd Edition, New Age International Private Limited (1 January 2019), ISBN-13 : 978-8122438024.
5. B. D. Singh- A textbook of Biotechnology, BSc Edition, Kalyani Publishers, (1 January 2015), ISBN-13 : 978-9327220650

E-References

<https://doi.org/10.3389/fmicb.2021.703284>

<https://doi.org/10.3389/fmicb.2021.703284>

<https://doi.org/10.1007%2Fs13197-012-0899-1>

<https://doi.org/10.1038%2Fs41587-022-01239-9>

<https://doi.org/10.4103%2F0975-7406.84430>



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

F.Y.B.Sc. Biotechnology (NEP 2023 Pattern)

Course/ Paper Title	Biotechnology- Introduction and its applications
Course Code	23SBBT110E
Semester	I
No. of Credits	2

Aims & Objectives of the Course

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

Expected Course Specific Learning Outcome

Sr. No.	Learning Outcome
1.	Students will understand the importance of biotechnology in day to day life.
2.	Students will understand the process of production of bio-based products like cheese and wine in industry.
3.	Students will understand the applications of biotechnology.
4.	Students will be acquainted with the different branches of biotechnology.

Syllabus

Unit No	Title and Contents	No of lectures
Credit I	Introduction to Biotechnology	15
Chapter 1	Biotechnology- Definition, Introduction, Role of Biotechnology in day to day life, Milestones in the history of Biotechnology.	4
Chapter 2	Various branches of Biotechnology with their applications in the field of life sciences: Yellow biotechnology, Blue biotechnology, Green biotechnology, White biotechnology, Grey biotechnology, Red biotechnology, Brown biotechnology, Gold biotechnology, Violet biotechnology, Dark biotechnology.	8
Chapter 3	Environmental Biotechnology and its applications - Waste water treatment and Bioremediation	3
Credit II	Applications of Biotechnology	15
Chapter 4	Biotechnology in food and dairy- Functional foods, Prebiotics, Probiotics, Nutraceuticals and their applications in human welfare.	7
Chapter 5	Red Biotechnology- Bio-based kits and Antibiotics	4
Chapter 6	Set-up of an industry: Parts of an industry and its functions, A basic layout of set-up of an industry.	4

References:

1. L.E.J.R. Casida- Industrial microbiology, 2nd Edition, New Age International Private Limited (1 January 2019), ISBN-13 : 978-8122438024.
2. Purohit, Biotechnology: Fundamentals and application, Agrobios (India) (January, ISBN- : 978-8177541397
3. B. D. Singh- A textbook of Biotechnology, BSc Edition, Kalyani Publishers, (1 January 2015), ISBN-13 : 978-9327220650

4. William Bains- Biotechnology from A to Z, OUP Oxford; 3rd edition (12 March 2004), ISBN-13 : 978-0198524984.

5. A. Whitaker- Principles of Fermentation Technology, 2nd edition, Butterworth-Heinemann Ltd, ISBN-13 : 978-0750645010

E-References

<https://doi.org/10.1007%2Fs13197-012-0899-1>

<https://doi.org/10.1038%2Fs41587-022-01239-9>

<https://doi.org/10.3389/fmicb.2021.703284>

<https://doi.org/10.3389/fmicb.2021.703284>

<https://doi.org/10.4103%2F0975-7406.84430>



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

T.Y.B.Sc. Biotechnology Semester VI

Offered as	Minor
Course/Paper Title	Cancer biology
Course Code	23SBBT61MN
Semester	VI
No. of Credits	2
Total Teaching Hours	30

Course Objectives	
1.	To introduce the concept of cancer biology.
2.	To inculcate the knowledge of causes, types and various stages of cancer.
3.	To make students familiar with the basic knowledge of mutations involved in cancer.
4.	To make students understand the diagnosis and treatment of cancer.

Course Outcome	
1.	Students will understand the properties of normal cell and cancer cell.
2.	Students will be familiar with the knowledge of types and various stages of cancer.
3.	Students will know the challenges for current therapies to treat cancer.

Syllabus		
Chapter	Title and Contents	Total Hours
1.	Introduction to cancer- Definition of cancer and causes of cancer, universal properties of normal cell, properties of cancer cell, benign tumor vs malignant tumor, types of cancer, various stages of cancer, definition of primary and secondary cancer with examples.	09
2.	Types of mutations involved in cancer- Loss of function, gain of function and frame-shift mutations mutations involved in cancer, role of tumor suppressor genes and proto-oncogenes (p53) in cancer	09

3.	Cancer classification- TNM classification- Purpose and types of staging and factors affecting the staging system.	05
4.	Cancer diagnosis and treatment- Clinical examination, radiological examination, biopsy and it's types, radiotherapy, chemotherapy, monoclonal antibodies used for treatment of cancer.	07

References

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, *Molecular biology of the Cell*, WW Norton & Co, ISBN-13 : 978-0393884852, 7th Edition, July 2022 .
2. Lodish, Harvey; Berk, Arnold; Matsudaira, Paul; Kaiser, *Molecular Cell Biology*, W.H.Freeman & Co Ltd, ISBN-13 : 978-0716743668, 5th revised edition, August 2003.
3. Gerald Carp, *Cell biology*, Wiley Publishers, ISBN-13 : 978-1118318744, 7th edition, May 2013.
4. David Nelson & Michael Cox, -Lehninger, Principles of Biochemistry, W.H. Freeman and company, NY, ISBN-13: 978-1319108243 ISBN-10: 9781319108243, 5th Edition, January 2017.
5. Lewis J. Kleinsmith, *Principles of Cancer Biology*, Pearson Education India, ISBN-13 978-9332577480, First Edition, 29 July 2016.
6. Robin Hesketh, *Introduction to Cancer Biology*, Cambridge University Press, ISBN-13 97813165126162023, revised edition, 2023.

E- Resources

1. <https://www.sciencedirect.com/science/article/pii/S2311300617300125>
2. <https://pmc.ncbi.nlm.nih.gov/articles/PMC5696686/>
3. <https://pmc.ncbi.nlm.nih.gov/articles/PMC9012285/>
4. <https://www.pnas.org/doi/10.1073/pnas.0334858100>
5. <https://www.sciencedirect.com/science/article/pii/S1773224724002685>

T.Y.B.Sc. Biotechnology Semester VI

Offered as	Minor
Course/Paper Title	Practicals in bioprocessing and fermentation technology
Course Code	23SBBT62MN
Semester	VI
No. of Credits	2
Total Teaching Hours	60

Course Objectives	
•	To introduce students to the basic techniques of bioprocessing and fermentation technology
•	To understand the production and analysis of bio-based products.
•	To provide knowledge of applications of these techniques in research and industry.

Course Outcome	
•	Students will also get basic knowledge of commercially important micro-organisms.
•	Students will become familiar with the production and analysis of bio-based products.
•	Students will be able to apply these techniques in various fields of life sciences and in research.

Syllabus		
Sr. No	Title and Contents	Total Practicals
1	Bacterial growth curve	02
2	Determination Thermal death point of micro-organisms	02
3	Production and analysis of ethanol.	04
4	Production and analysis of amylase	02
5	Production and analysis of lactic acid	02
6	Isolation of industrially important organisms from natural sources.	02

References books:

1. Roger Y Stanier, John L Ingraham, Mark L Wheelis, Page R Painter, *General Microbiology*, Palgrave Macmillan Publisher, ISBN-13 978-0333763643, 5th edition, 23 June 1999.
2. A. Whitaker, *Principles of Fermentation Technology*, Butterworth-Heinemann Ltd, ISBN-13 978-0750645010, 2nd edition, 15 December 1998.
3. L.E.J.R. Casida, *Industrial Microbiology*, New Age International Private Limited, ISBN-13 978-8122438024, 2nd edition, 1 January 2019.
4. H. J. Pepler, D. Perlman, *Microbial Technology: Fermentation Technology*, Academic Press, 2nd edition, Volume II, 10 May 2014.
5. B.D. Singh, *Biotechnology*, Kalyani Publishers, ISBN-13 978-9327220650, 1 January 2015.

E- Resources

1. <https://pmc.ncbi.nlm.nih.gov/articles/PMC7802944/>
2. <https://www.sciencedirect.com/science/article/pii/S0362028X22068831>
3. <https://www.sciencedirect.com/science/article/abs/pii/S0734975019300072>
4. <https://pmc.ncbi.nlm.nih.gov/articles/PMC8481070/>
5. <https://www.sciencedirect.com/science/article/abs/pii/S0016236122003143>

T.Y.B.Sc. Biotechnology (Minor), Semester IV

Offered as	Minor
Course/Paper Title	Medical biotechnology
Course Code	23SBBT41OE
Semester	IV
No. of Credits	2
Total Teaching Hours	30

Course Objectives	
1.	To provide a platform for study of vaccines, stem cells and genetic disorders.
2.	To introduce the concepts of basic medical tests and their significance in diagnosis of a disease.
3.	To highlight the applications of biotechnology in diagnosis of diseases and disorders.

Course Outcome	
1.	Students will understand the applications of biotechnology in medical field.
2.	Students will be familiar with the knowledge of basic medical tests and their significance in diagnosis of a disease.
3.	Students will know the importance of vaccines, stem cell therapy and its applications.

Syllabus		
Chapter	Title and Contents	Total Hours
1.	Role of Biotechnology in clinical biochemistry- Blood and its types- types of blood cells, functions of blood cells, normal levels of RBC's, WBC's, hemogram, platelets and their clinical significance.	06
2.	Overview of medical tests and their significance in disease diagnosis- ECG, CT-Scan, MRI scan, X-ray, sonography.	06
3.	Vaccine production – Definition of vaccine and types of vaccines with examples	03
4.	Stem cell therapy – Introduction to stem cells - Types of stem cells, properties and their applications.	05
5.	Diagnostic kits – Introduction to diagnostic products, examples of diagnostic kits with it's applications.	05
6.	Overview of genetic disorders- X- linked disorders and Y- linked disorders with examples.	05

References

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, *Molecular biology of the Cell*, WW Norton & Co, ISBN-13 : 978-0393884852, 7th Edition, July 2022.
2. William J. Marshall, *Clinical Biochemistry Metabolic and Clinical Aspects*, Elsevier India Publisher, ISBN-13 978-8131270776, 29 June 2024.
3. Najat Rashid, *Textbook of Clinical Chemistry*, Peepee Publishers and Distributors, ISBN-13 978-8184452754, 28 August 2020.
4. Janis Kuby, *Immunology*, W.H.Freeman & Co Ltd, ISBN-13 978-0716724001, 2nd edition, 1st November 1995.
5. John E. Hall, *Guyton and Hall Textbook of Medical Physiology*, Elsevier Health Sciences Publisher, ISBN 9781437726749, 12th Edition, 2010.

E- Resources

1. <https://www.ncbi.nlm.nih.gov/books/NBK549803/>
2. <https://www.sciencedirect.com/science/article/pii/S1078817423002481>
3. <https://www.nature.com/articles/s41392-022-01134-4>
4. <https://www.ncbi.nlm.nih.gov/books/NBK557383/>
5. <https://www.sciencedirect.com/topics/medicine-and-dentistry/y-chromosomal-inheritance>