



**Deccan Education Society's**  
**Fergusson College (Autonomous)**  
**Pune**

Learning Outcomes-Based Curriculum  
for 3/4 years B.Sc /B.Sc (Honours) Programme  
as per guidelines of  
**NEP-2020**

for  
**F. Y. B. Sc. (Biotechnology)**  
With effect from Academic Year  
**2024-2025**

**Fergusson College (Autonomous), Pune**  
**NEP 2.0 Subject Credit distribution Structure 2024-25**  
**Department of Biotechnology (Science)**

<b>FYBSc Sem -I</b>	<b>Theory/ Practical</b>	<b>Paper Code</b>	<b>Paper Title</b>	<b>Credits</b>	<b>Exam type</b>
Discipline Specific Core, DSC-1	Theory	BTH- 1001	Fundamentals of Biotechnology - I	2	CE +ESE
Discipline Specific Core, DSC-2	Practical	BTH- 1011	Biotechnology Practical 1	2	CE +ESE

<b>FYBSc Sem - II</b>	<b>Theory/ Practical</b>	<b>Paper Code</b>	<b>Paper Title</b>	<b>Credits</b>	<b>Exam type</b>
Discipline Specific Core, DSC-3	Theory	BTH- 1002	Fundamentals of Biotechnology - II	2	CE +ESE
Discipline Specific Core, DSC-4	Practical	BTH- 1012	Biotechnology Practical 2	2	CE +ESE
Skill Enhancement Course, SEC-1	Theory/ Practical	BTH- 1032	Biostatistics and Computers	2	Only CE

Head

Department of Biotechnology

F.Y.B.Sc. Semester I		
<b>BTH-1001</b>	<b>Fundamentals of Biotechnology-I</b> <b>Theory</b> <b>(Discipline Specific Core, DSC 1)</b>	<b>Credits: 2</b> <b>Hours: 30</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		<b>Bloom's Cognitive Level</b>
CO1	Recall the concept of origin of life and evolution of cells.	1
CO2	Explain characteristics of animal and plant life forms and describe their tissue organisation.	2
CO3	Apply the knowledge of different life forms to study their associations.	3

Sr. No	Topic	Number of lectures (30)
1	<b>Introduction and scope of Biotechnology.</b>	2
2	<b>Introduction to cell and its function:</b> <ul style="list-style-type: none"> <li>● Origin of life: Unicellularity to multicellularity</li> <li>● Evolution of cells: events and factors responsible (endosymbiosis, vertical and horizontal gene transfer etc.)</li> <li>● Comparative account of archaebacteria, prokaryotic and eukaryotic cell.</li> <li>● General Characteristics of different Animal and Plant Life Forms.</li> </ul>	10
3	<b>Animal Tissue organisation and functions:</b> <ul style="list-style-type: none"> <li>● Introduction to animal tissue systems – epithelial tissue, muscular tissue, connective tissue, nervous tissue.</li> <li>● Introduction to Cell junctions- relevance to tissue structure.</li> </ul>	6
4	<b>Plant Tissue organisation and function:</b> <ul style="list-style-type: none"> <li>● Epidermal, Ground, Vascular, Mechanical tissue systems;</li> <li>● Morphology- Vegetative and reproductive plant parts;</li> <li>● Anatomy- Vegetative and reproductive plant parts</li> <li>● Plant cell wall - primary and secondary.</li> </ul>	6

5	<b>Multi life form associations and their significance:</b> <ul style="list-style-type: none"><li>● Competition, commensalism, mutualism and parasitism with suitable examples.</li></ul>	6
---	---	---

**References:**

1. Principles of Anatomy and Physiology by Gerard Tortora and Bryan Derrickson 16th Edition. 2020
2. Animal Physiology by Christopher Moyes and Patricia Schulte, Third edition (Pearson), 2021.
3. Animal Physiology by Hill, Wyse and Anderson, fourth edition, 2016.
4. Botany for Degree students- Angiosperms by B. R. Vashishta
5. Class book of Botany- by A.C. Dutta
6. College Botany Vol.I, II, III by Ganguli, Das Dutta.
7. Taxonomy of Vascular Plants by G H. Lawrence
8. Plant Physiology- by Taiz,L. and Zeiger E.
9. Molecular Cell Biology. Lodish H., Berk A, Kaiser C., K Reiger M., Bretscher A., Ploegh H., Angelika Amon A., Matthew P. Scott M.P., 8th Edition, (2016) W.H. Freeman and Co., USA
10. Molecular Biology of the Cell, Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, 6th Edition (2014) Garland Science, USA
11. Cell Biology, Gerald Karp. 9th edition, (2020) John Wiley & Sons., USA
12. The Cell: A Molecular Approach, Geoffrey M. Cooper, Robert E. 7th edition (2015), Hausman, Sinauer Associates, Inc. USA
13. Becker's World of then Cell, Jeff Hardin, Gregory Bertoni, Lewis J.Kleinsmith, 8<sup>th</sup> Edition (2016), Pearson Education Limited, USA

<b>F.Y.B.Sc. Semester I</b>		
<b>BTH-1011</b>	<b>Biotechnology Practical 1</b> <b>Practical</b> <b>(Discipline Specific Core, DSC 2)</b>	<b>Credits: 2</b> <b>Hours: 30</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		<b>Bloom's Cognitive Level</b>
CO1	Define Good Laboratory Practices for safety in laboratories and study basic instruments of biotechnology.	1
CO2	Compare and study different life forms.	2
CO3	Examine different types of animal and plant cells and determine the cell size.	3

<b>Sr. No</b>	<b>Topic</b>	<b>Number of practicals (15P x 4H)</b>
1	Good Laboratory Practices, Lab safety and introduction to common laboratory glassware and instruments.	2
2	Working, use and care of compound microscopes.	2
3	Study of different life forms from pond water/ any other suitable source.	2
4	Peripheral blood smear and study of different cell types.	2
5	Study of plant tissues by maceration.	2
6	Determination of cell size by micrometry.	3
7	Study of association of life forms	2

F.Y.B.Sc. Semester II		
<b>BTH-1002</b>	<b>Fundamentals of Biotechnology-II</b> <b>Theory</b> <b>(Discipline Specific Core, DSC -3)</b>	<b>Credits: 2</b> <b>Hours: 30</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		<b>Bloom's Cognitive Level</b>
CO1	Describe specialized cell types, phases of cell cycle and homeostatic regulation.	1
CO2	Associate the role of model organisms and biotechnology in different fields.	2
CO3	Apply the knowledge of tissue structures for histological processing.	3

Sr. No	Topic	Number of lectures (30)
1	<p><b>Specialized cell types</b></p> <ul style="list-style-type: none"> <li>● photoreceptors, gametes, auditory hair cells, ciliated cells.</li> </ul> <p><b>Cell division and Cell Cycle</b></p> <ul style="list-style-type: none"> <li>● Phases of cell cycle.</li> <li>● Mitosis, meiosis in plants and animals.</li> </ul>	5
2	<p><b>Homeostasis:</b></p> <ul style="list-style-type: none"> <li>● Introduction</li> <li>● Feedback mechanism</li> <li>● Maintenance of blood pH; Thermoregulation</li> <li>● Osmosis, Turgor pressure, and transpiration.</li> </ul>	7
3	<p><b>Methods in histology:</b></p> <ul style="list-style-type: none"> <li>● Histological processing- sampling, fixing, dehydrating, embedding, sectioning, and staining</li> <li>● Principles and examples of cell type specific staining methods for plant and animal cells.</li> </ul>	3
4	<p><b>Model systems used in Biotechnology: Features and relevance</b></p> <ul style="list-style-type: none"> <li>● Animal models: <i>C. elegans</i>, Hydra, Drosophila, Zebra Fish.</li> <li>● Plant models: <i>Arabidopsis thaliana</i>, <i>Datura stramonium</i>, Fucus.</li> </ul>	7

5	<p><b>Applications of Biotechnology:</b></p> <ul style="list-style-type: none"> <li>● Biotechnology in Health, Industry, Environment, Agriculture.</li> <li>● Economic importance of microbes, plants (Secondary metabolites) and animals;</li> <li>● Vermiculture, Sericulture, Pearl culture, Apiculture</li> </ul>	8
---	---	---

**References:**

1. Principles of Anatomy and Physiology by Gerard Tortora and Bryan Derrickson 16th Edition. 2020
2. Animal Physiology by Christopher Moyes and Patricia Schulte, Third edition (Pearson), 2021.
3. Animal Physiology by Hill, Wyse and Anderson, fourth edition, 2016.
4. Botany for Degree students- Angiosperms by B. R. Vashishta
5. Class book of Botany- by A.C. Dutta
6. College Botany Vol.I, II, III by Ganguli, Das Dutta.
7. Taxonomy of Vascular Plants by G H. Lawrence
8. Plant Physiology- by Taiz,L. and Zeiger E.
9. Molecular Cell Biology. Lodish H., Berk A, Kaiser C., K Reiger M., Bretscher A., Ploegh H., Angelika Amon A., Matthew P. Scott M.P., 8th Edition, (2016) W.H. Freeman and Co., USA
10. Molecular Biology of the Cell, Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, 6th Edition (2014) Garland Science, USA
11. Cell Biology, Gerald Karp. 9th edition, (2020) John Wiley & Sons., USA
12. The Cell: A Molecular Approach, Geoffrey M. Cooper, Robert E. 7th edition (2015), Hausman, Sinauer Associates, Inc. USA
13. Becker's World of then Cell, Jeff Hardin, Gregory Bertoni, Lewis J.Kleinsmith, 8<sup>th</sup> Edition (2016), Pearson Education Limited, USA

<b>F.Y.B.Sc. Semester II</b>		
<b>BTH-1012</b>	<b>Biotechnology Practical 2</b> <b>Practical</b> <b>(Discipline Specific Core, DSC-4)</b>	<b>Credits: 2</b> <b>Hours: 30</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		<b>Bloom's Cognitive Level</b>
CO1	Identify different stages of cell division and anatomical features of plant tissues.	1
CO2	Demonstrate the phenomenon of osmosis.	2
CO3	Carry out culturing of model organisms.	3

<b>Sr. No</b>	<b>Topic</b>	<b>Number of practicals (15P x 4H)</b>
1	Study of mitosis (onion root tip) – preparation of slides and identification of different stages.	2
2	Study of meiosis (grasshopper testis/ <i>Tradescantia</i> anther)– preparation of slides and identification of different stages.	2
3	Permanent slide preparation of simple tissue structures.	2
4	Study of osmosis in plants.	2
5	Study of anatomical features of root, stem and leaves of Dicotyledons and Monocotyledons (sectioning and staining).	2
6	Culturing and study of <i>Drosophila</i> .	4
7	Visit to a Sericulture/ Vermiculture /Apiculture facility.	1



F.Y.B.Sc. Semester II		
<b>BTH-1032</b>	<b>Biostatistics and Computers</b> <b>(Skill Enhancement Course, SEC-1)</b>	<b>Credits: 2</b> <b>Hours: 30</b>
<b>Course Outcomes (COs)</b> <b>On completion of the course, the students will be able to:</b>		<b>Bloom's Cognitive Level</b>
CO1	Describe data collection and organization methods.	1
CO2	Summarize different types of data.	2
CO3	Interpret the experimental data and analyse.	3
Unit	Contents	No. of Lectures
	Biostatistics	15
I	Introductory Statistics: The need of statistics in biology; Variables and constants  Types of variables – discrete, continuous  Types of data – raw, grouped  Graphical representation of data – bar graphs, scatter plots, frequency diagrams, pie chart, histogram, polygon, curve	3
II	Descriptive Statistics: Definition and simple problems related to Measures of Central Tendency – Mean, median and mode, Quartiles  Measures of dispersion – Standard deviation, variance, coefficient of variance, correlation and regression	4
III	Hypothesis Testing: Hypothesis formulation- Null and alternative hypothesis.  Parametric and non-parametric tests: Z-test, t-test, Chi-square test, ANOVA. Std error, Type I and Type II errors, Confidence, Significance.	5
IV	Probability: Classical definitions and its limitations, Independence and conditional probability, Probability sampling Population, sample, sampling methods – Simple random, stratified	3
	Computers	15
I	History of Computers: Evolution, generations of computers – I to V	1
II	Microsoft Excel: The Excel environment, Entering and editing data, Modifying a worksheet, Using functions, Formatting, Printing,	3

	<p>Charts : Chart basics, Pie Chart, Bar Chart, Line Diagram, Trend lines, Range names and Filter date : Define and apply cell and range names : Use names in Formulas, Filter data based on complex criteria, Use conditional filters, Copy filtered results to another range, Pivot Tables: Prepare data in a table format and name the table, Create a PivotTable for analysing.</p>	
III	<p>Microsoft Word: Creating the documents and Tabulating the data using word and its formatting, Find &amp; Replace, Spell Checker &amp; Grammar Checker.</p> <p>Citation and Referencing using Microsoft word and Mendeley Microsoft word plugin.</p> <p>Use of Microsoft word while writing research paper, collaboration and sharing in word, Tracking the changes in the documents, Creation of Hyperlinks, Bookmarks and Cross Referencing.</p>	2
IV	<p>Microsoft Powerpoint: Creation of Presentations with graphics, Creation of slides, Preparation of scientific presentations.</p> <p>Insert and Format Text, Shapes and Text Boxes, Images, Order and Group Objects.</p> <p>Insert and Format Tables,Charts,SmartArt graphics, Insert and Manage Media.</p> <p>Apply Slide Transitions,Animate Slide Content,Set Timing for Transitions and Animations.</p> <p>Infogram: A very easy-to-use tool for creating template, visually appealing data visualisations and infographics.</p> <p>BioRender Scientific Image and Illustration Software: BioRender figures to PowerPoint presentations &amp; keep them updated in a click.</p>	2
V	<p>Databases: Basic concepts in: Data abstraction, Data models , Instances and schemes, E-R model (Entity and entity sets, relations and relationship sets, E-R diagrams, reducing E-R diagrams to tables),Network data model, Basic concepts, multimedia databases, Text databases.</p> <p>Database Applications (Microsoft Access): Fields, Records, Files, Organization of Files, Access Modes; Updating Records, Querying, Reports, Forms &amp; subforms,</p>	7

**References:**

1. Robert Bartle., and Donald Sherbert. Introduction to real analysis.4th ed. Illinois, USA: John Wiley& Sons, Inc., USA, 2011.
2. Chap T. Le. Introductory Biostatistics. 1st ed. New Jersey, USA: John Wiley& Sons, Inc., USA, 2003.
3. Antony N Glaser. High-Yield™ Biostatistics. Maryland, USA: Lippincott Williams and Wilkins, USA, 2005.