

**“Education for Knowledge, Science and Culture”**

**-Shikshanmaharashi Dr Bapuji Salunke**



**VIVEKANAND COLLEGE, KOLHAPUR**

**(EMPOWERED AUTONOMOUS INSTITUTE)**

**DEPARTMENT OF BIOTECHNOLOGY (OPTIONAL)**

**B.Sc. Part III - Biotechnology-Optional Semester V & VI**

**Academic year 2025-26**

**Department of Biotechnology (Optional)**  
**Departmental Teaching and Evaluation scheme**  
**Third Year Semester-V & VI**

| Sr. No.            | Course Abbr. | Course code | Course Name                                        | Teaching Scheme Hours/week |    | Examination Scheme and Marks |     |     |       | Course Credits |
|--------------------|--------------|-------------|----------------------------------------------------|----------------------------|----|------------------------------|-----|-----|-------|----------------|
|                    |              |             |                                                    | TH                         | PR | ESE                          | CIE | PR  | Marks |                |
| Semester-V         |              |             |                                                    |                            |    |                              |     |     |       |                |
| 1                  | DSC-IX       | DSC03BIT51  | Biochemical techniques                             | 2                          | -  | 40                           | 10  | -   | 50    | 2              |
| 2                  | DSC-X        | DSC03BIT52  | Environmental Biotechnology                        | 2                          | -  | 40                           | 10  | -   | 50    | 2              |
| 3                  | DSC-XI       | DSC03BIT53  | Plant tissue culture                               | 2                          | -  | 40                           | 10  | -   | 50    | 2              |
| 4                  | DSE-I        | DSE03BIT51  | Fermentation technology-I                          | 2                          | -  | 40                           | 10  | -   | 50    | 2              |
|                    |              | DSE03BIT52  | Basics of research Methodology for Biotechnology-I |                            |    |                              |     |     |       |                |
| 5                  | VSC-PR-IV    | VSC 03BIT59 | Basic techniques in Computers and Bioinformatics   | -                          | 4  | -                            | -   | 25  | 25    | 2              |
| 6                  | FP           | FPR03BIT51  | Field Project                                      |                            | 1  |                              |     | 50  | 50    | 2              |
| 7                  | DSC-PR-V     | DSC03BIT59  | DSC Biotechnology Lab-5                            | -                          | 16 | -                            | -   | 75  | 75    | 8              |
| 8                  | MIN-IX       | MIN03BIT51  | Plant Biotechnology                                | 2                          |    | 40                           | 10  |     | 50    | 2              |
| 9                  | MIN-PR-V     | MIN03BIT59  | MIN Biotech Lab-5                                  |                            | 4  | -                            | -   | 25  | 25    | 2              |
| Semester –V Total  |              |             |                                                    | 10                         | 24 | 200                          | 50  | 175 | 425   | 22             |
| Semester-VI        |              |             |                                                    |                            |    |                              |     |     |       |                |
| 1                  | DSC-XIII     | DSC03BIT61  | Gene Technology and Bioinformatics                 | 2                          | -  | 40                           | 10  | -   | 50    | 2              |
| 2                  | DSC-XIV      | DSC03BIT62  | Fundamentals of Animal Tissue Culture              | 2                          | -  | 40                           | 10  | -   | 50    | 2              |
| 3                  | DSC-XV       | DSC03BIT63  | Fundamentals of Cell Metabolism and Virology       | 2                          | -  | 40                           | 10  | -   | 50    | 2              |
| 4                  | DSE-II       | DSE03BIT61  | Fermentation technology -II                        | 2                          | -  | 40                           | 10  | -   | 50    | 2              |
|                    |              | DSE03BIT62  | Basics of Stem cell technology                     |                            |    |                              |     |     |       |                |
| 5                  | VSC-PR-V     | MIN03BIT61  | Entrepreneurship                                   | -                          | 4  | -                            | -   | 25  | 25    | 2              |
| 6                  | OJT          | OJT03BIT61  | On Job Training                                    |                            | 1  |                              |     | 50  | 50    | 2              |
| 7                  | DSC-PR-VI    | DSC03BIT69  | DSC Biotechnology Lab-6                            | -                          | 16 | -                            | -   | 75  | 75    | 8              |
| 8                  | MIN-X        | MIN03BIT61  | Animal Biotechnology                               | 2                          | -  | 40                           | 10  |     | 50    | 2              |
| 9                  | MIN-PR-VI    | MIN03BIT69  | MIN Biotechnology Lab-6                            |                            | 4  |                              |     | 25  | 25    | 2              |
| Semester –VI Total |              |             |                                                    | 10                         | 24 | 200                          | 50  | 175 | 425   | 22             |

**VIVEKANAND COLLEGE KOLHAPUR, (EMPOWERED AUTONOMOUS INSTITUTE)**

**Department of Biotechnology (Optional)**

**B.Sc. III Sem-V and Sem-VI**

**Program Specific Outcomes (PSOs) / Course Outcomes (CO) /**

**Program Outcomes (PO)**

**Program Specific Outcome (PSO):**

PSO 1 Graduates will be able to apply knowledge of biotechnology to conserve flora & fauna.

PSO 2 Graduates will be able to outline various projects for human welfare & social awareness

PSO 3 Graduates will be able to perform various techniques in Life sciences.

PSO 4 Graduates will be able to differentiate plant & animals to species level.

## **Semester V**

### **Programme Outcome POs**

1. Graduates will gain and apply knowledge of life science to solve problems related to field of Biotechnology mainly plant and animal tissue culture
2. Graduate will be applying appropriate tools and techniques in plant and animal Biotechnology
3. Graduates will be able study industrial biotechnology and related concepts
4. Graduates are able to know required terms and conditions in fermentation processes
5. Students gain basic knowledge regarding ethical issue and IPR and related concept

## **Semester VI**

### **Programme outcome POs**

1. Graduate will be able to understand need and impact of Biotechnological solution on environmental and social content keeping in view in sustainable solution
2. Graduates will gain and apply knowledge of biochemical techniques and gene technology. bioinformatics
3. Graduates will be able to decide and apply appropriate tools and techniques in biotechnology.
4. Graduates will be able to understand the need and importance virus study
5. Graduates are able to understand biomolecules and their respective metabolism.

**“Education for Knowledge, Science and Culture”**

-Shikshanmaharashi Dr. Bapuji Salunkhe

**Shri Swami Vivekanand Shikshan Sanstha's**

**VIVEKANAND COLLEGE, KOLHAPUR**

**(EMPOWERED AUTONOMOUS INSTITUTE)**

**Department of Biotechnology Optional**

**Academic year 2025-26**

**B.Sc. III Biotechnology Optional**

**Semester V and VI Course Outcomes (COs)**

| <b>Semester</b>   | <b>Course outcome</b>                                                                                                                                                                                                                                                                                                                                                               |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Semester V</b> |                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>DSC-IX</b>     | <b>DSC03BIT 51 Biochemical technique</b>                                                                                                                                                                                                                                                                                                                                            |
|                   | 1.CO: To acquire knowledge about various advancements in applied biotechnology<br>2.CO: To acquire and learn about various centrifugation techniques, and protein precipitation.<br>3.CO: To study the use of chromatographic techniques and tracer technique<br>4. CO: After completing the course students are eligible to apply knowledge of electrophoresis in protein research |
| <b>DSC-X</b>      | <b>DSC 03BIT52 - Environmental Biotechnology</b>                                                                                                                                                                                                                                                                                                                                    |
|                   | 1.CO: Implementation of green revolution i.e. to attain reduce, reuse & recycle<br>2.CO :To acquire knowledge and techniques related to wastewater treatment<br>3.CO: To acquire knowledge to grow healthy crops without chemical pesticides.<br>4.CO : To study Modern fuels and their applications                                                                                |
| <b>DSC- XI</b>    | <b>DSC03BIT53 Plant tissue culture</b>                                                                                                                                                                                                                                                                                                                                              |
|                   | 1.CO. To gain knowledge regarding basic concepts of plant tissue culture laboratory.<br>2.CO. To acquire knowledge about how to cultivate plant tissues <i>in vitro</i><br>3.CO. To study various types of tissue culture<br>4.CO. Construct to design the commercial plant tissue culture laboratory                                                                               |
| <b>DSE-I</b>      | <b>DSE 03BIT51 Elective- Fermentation technology –I</b>                                                                                                                                                                                                                                                                                                                             |
|                   | 1.CO. To learn about different designs of fermenters.<br>2.CO. To study the isolation of industrially important microbial strain production<br>3. CO. To learn the determination of the end product of fermentation.<br>4.CO: To gain knowledge regarding Upstream and Downstream processing at fermentation industries                                                             |
| <b>DSE-I</b>      | <b>DSC03BIT 52 Elective – Research and methodology</b>                                                                                                                                                                                                                                                                                                                              |
|                   | 1. CO. To understand regarding research .<br>2 CO. To aware the students how to write research article.<br>3 CO. To learn about the use of Tools and Techniques of Research Methods.<br>4 CO . To gain knowledge about the Research methodology in Biotechnology.                                                                                                                   |
| <b>MIN-IX</b>     | <b>MIN03BIT51 Plant Biotechnology</b>                                                                                                                                                                                                                                                                                                                                               |

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | 1.CO. To gain knowledge regarding basic concepts of plant tissue culture laboratory.<br>2.CO. To acquire knowledge about how to cultivate plant tissues <i>in vitro</i><br>3.CO. To study various types of tissue culture<br>4.CO. Construct to design the commercial plant tissue culture laboratory                                                                                                                                                                                                                                                                  |
| <b>Semester VI</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>DSC XIII</b>    | <b>DSC03BIT61 Gene technology and Bioinformatics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                    | 1.CO: To understand important techniques in gene technology<br>2.CO: To learn about different therapies in gene technology<br>3.CO: To learn about applying Biotechnology in silico i.e. via Bioinformatics<br>4.CO: After completing the course students are eligible to work in molecular diagnostic and Bioinformatics laboratory.                                                                                                                                                                                                                                  |
| <b>DSC -XIV</b>    | <b>DSC03BIT62 -Fundamentals of animal tissue Culture</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                    | 1. CO. To understand need of animal tissue culture<br>2.CO. To learn about the cultivation of animal tissues <i>in vitro</i><br>3.CO. To gain knowledge about how to prepare and maintain animal tissues using various media and hormones<br>4.CO. Construct to design the commercial Animal tissue culture Laboratory                                                                                                                                                                                                                                                 |
| <b>DSC-XV</b>      | <b>DSC 03BIT 63 Cell metabolism and virology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                    | 1.CO: To acquire knowledge regarding biomolecules and their metabolism<br>2.CO: To learn about various metabolic pathways<br>3.CO. To understand the basics of viruses their structure, reproduction, and cultivation<br>4.CO: To study different virus cultivation techniques                                                                                                                                                                                                                                                                                         |
| <b>DSE-II</b>      | <b>DSE03BIT61 – Fermentation technology-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                    | 1 .CO. To understand various types of fermentation<br>2.CO. To learn about different fermentation product<br>3.CO. To learn about Intellect Property Rights and patenting<br>4 CO: After competing for the course students are eligible to work in the production department in the fermentation industry                                                                                                                                                                                                                                                              |
| <b>DSE-II</b>      | <b>DSE03BIT 62 – Stem Cell technology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                    | CO:1. students get knowledge about Stem cell types ,mechanism of self renewal and differentiation.<br>CO:2. After completing the course students can understand the use of stem cell research and its potential implications .<br>CO:3. Students can develop analytical and critical thinking skills to design , conduct and analyze experiments in stem cell research .<br>CO: 4. students will able to prepare for careers in stem cell research , biotechnology or related fields such as research scientists ,corporate professionals ,or healthcare professionals |
| <b>MIN- X</b>      | <b>MIN03BIT 61 – Animal Biotechnology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                    | 1. CO. To understand need of animal tissue culture<br>2.CO. To learn about the cultivation of animal tissues <i>in vitro</i><br>3.CO. To gain knowledge about how to prepare and maintain animal tissues using various media and hormones.<br>4.CO. Construct to design the commercial Animal tissue culture Laboratory                                                                                                                                                                                                                                                |

**DSC03BIT51- Biochemical technique**

- 1.CO: To acquire knowledge about various advancements in applied biotechnology
- 2.CO: To acquire and learn about various centrifugation techniques, and protein precipitation.
- 3.CO: To study the use of chromatographic techniques and tracer technique
4. CO: After completing the course students are eligible to apply knowledge of electrophoresis in protein research

| Sr.No. | Content                                                                                                                                                                                                                                                                                                                                                   | Total Classes |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1      | <b>Unit 1- Chromatographic methods -</b><br>Principle, methodology, and applications of <ol style="list-style-type: none"><li>a) Gel Filtration method</li><li>b) Ion exchange chromatography &amp; Affinity chromatography</li><li>c) Gas-liquid chromatography (GLC)</li><li>d) High-Performance Liquid chromatography</li></ol>                        | 07            |
| 2      | <b>Spectroscopic method –</b><br>Principle, instrumentation, and applications <ol style="list-style-type: none"><li>a) Infra-red spectroscopy</li><li>b) Fluorescence spectroscopy</li><li>c) Atomic spectroscopy</li><li>d) Mass spectroscopy</li></ol>                                                                                                  | 08            |
| 3      | <b>Electrophoresis:</b><br>Introduction, types, and general principle<br>Supporting media – (Agarose, Polyacrylamide gel)<br>Electrophoresis of proteins<br>SDS-PAGE electrophoresis- Methodology and Applications.<br>Isoelectric focusing                                                                                                               | 07            |
| 4      | <b>Tracer technique; -</b><br>Introduction – Radioactivity, radioisotopes, types of radiation ( $\alpha$ , $\beta$ , $\gamma$ ), half-life period of the radioisotope, Methods of measurement of radioactivity<br>Gas ionization, Solvent excitation- Liquid scintillation counter, Autoradiography<br>Applications of radioisotopes in biological system | 08            |

**Reference Books-**

1. Practical Biochemistry principles and techniques – Wilson and Walkar
2. Protein purification – Robert Scoop
3. Biophysical Chemistry – Nath Upadhyay
4. Textbook of Biotechnology- R.C. Dubey
5. Textbook of Biotechnology- B.D. Singh

### DSC03BIT52- Environmental Biotechnology

- 1.CO: Implementation of green revolution i.e. to attain reduce, reuse & recycle
- 2.CO :To acquire knowledge and techniques related to wastewater treatment
- 3.CO: To acquire knowledge to grow healthy crops without chemical pesticides.
- 4.CO : To study Modern fuels and their applications

| Sr.No. | Content                                                                                                                                                                                                                                                                                                                                                                               | Total Classes |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1      | <b>1) Conventional and Nonconventional fuel and environmental impact</b><br>2) Modern fuel-Biogas, Bioethanol, and Biodiesel production<br>3) Global environmental problems - Greenhouse effect, ozone depletion, acidrain                                                                                                                                                            | 07            |
| 2      | <b>2) Wastewater treatment-</b> <ul style="list-style-type: none"> <li>• Primary treatment - Screening, grinding, grit removal, flocculation, sedimentation, coagulation</li> <li>• Secondary treatment - Aerobic (Trickling filter, activated sludge, stabilization pond) and Anaerobic (Up-flow anaerobic sludge digestion)</li> </ul> Tertiary treatment - chemical, precipitation | 08            |
| 3      | <b>1) Bioremediation-</b> Define, Types, Examples - hydrocarbon, dye, heavymetals, pesticides<br><b>2) Bioremediation in Agriculture</b> (Composting and vermicomposting)<br><b>3) Bio pesticides, Bio sorption, Phytoremediation</b><br><b>4) Bioleaching-</b> Types, Chemistry, and examples - Copper and Uranium                                                                   | 08            |
| 4      | <b>Introduction to Bio fertilizer</b> - Inoculants of <i>Rhizobium</i> , <i>Azotobacter</i> , <i>Frankia</i> , Cyanobacteria, Phosphate solubilizing bacteria (PSB) with methods of applications.                                                                                                                                                                                     | 07            |

#### Reference Book

1. Environmental biotechnology- InduShekhar Thakur.
2. Environmental biotechnology- Chattergy.
3. Environmental biology -Verma& Agarwal.
4. Environmental chemistry-B.K.Sharma.
5. Environmental Pollution- Peavy& Rowe.
6. Environmental problems & solutions- Asthana & Asthana.
7. Environmental science-SiagoCanninhham. 8.Environmental biotechnology-S.N.Jogdand

**DSC03BIT53- Plant Tissue Culture**

- 1.CO. To gain knowledge regarding basic concepts of plant tissue culture laboratory.
- 2.CO. To acquire knowledge about how to cultivate plant tissues *in vitro*
- 3.CO. To study various types of tissue culture
- 4.CO. Construct to design the commercial plant tissue culture laboratory

| Sr.No. | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Total Classes |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1      | <b>1)Concept &amp; Historical Background</b><br>Conventional and Non-conventional methods for crop improvement, Landmarks in plant tissue culture.<br><b>2) Concept of cell theory, Cellular totipotency, Differentiation, Dedifferentiation, Dedifferentiation, Regeneration.</b><br><b>3) Scope, recent advances &amp; applications of Plant Tissue Culture (PTC)</b><br><b>4) Infrastructure &amp; organization of Laboratory, Different work areas, Equipment &amp; Instruments required.</b>                                                | 08            |
| 2      | <b>1)Media &amp; culture preparation</b> Role of micro & macronutrients, vitamins, amino acid, hormones, activated charcoal and solidifying agents. Culture Conditions - pH, Temperature, Humidity.<br><b>2) Aseptic Techniques</b> Sterilization of Media, Reagent & Glassware, Surface sterilization of explants<br><b>3) Practical applications of tissue and organ culture</b> - Application in agriculture, application in horticulture and forestry, pharmaceuticals, research, paleobotany, applications in industries, transgenic plants | 07            |
| 3      | <b>1) Callus Culture</b><br>Introduction, principle, morphology & internal structure, protocol, factors affecting.<br><b>2) Somatic embryogenesis</b><br>Introduction, principle, protocol, factors affecting, applications.<br><b>3) Suspension Culture</b> Introduction, principle, protocol, growth measurement, synchronization, applications.                                                                                                                                                                                               | 07            |
| 4      | <b>1) Pathways for clonal propagation and Organogenesis</b><br>Introduction, principle, protocol, factors affecting, applications.<br><b>2)Haploid culture:</b> Introduction, principle, protocol, applications, advantages of pollen culture over anther culture<br><b>3)Concept of Soma clonal Variation Concept Protoplast culture</b>                                                                                                                                                                                                        | 08            |

Reference Books-

1. Introduction to plant tissue culture-M.K.Razdan
2. Plant tissue culture – Theory & practice- S.S.Bhojwani &M.K.Razdan
3. Crop improvement in biotechnology- H.S.Chawala
4. Plant tissue culture-Kalyankumar Dey    5. Textbook of biotechnology- R.C.Dubey



**DSE03BIT51 Fermentation technology –I**

- 1.CO. To learn about different designs of fermenters.
- 2.CO. To study the isolation of industrially important microbial strain production
3. CO. To learn the determination of the end product of fermentation.
- 4.CO: To gain knowledge regarding Upstream and Downstream processing at fermentation industries

| Sr.No. | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Total Classes |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1      | <b>Concept of Bioprocess Engineering and Fermentation Technology</b><br><b>Basic design of fermenter:</b> Construction materials and accessories associated with it.<br><b>Types of Fermenters-</b> Tube tower fermenter, Bubblecap fermenter, Fluidized bed fermenter, Airlift fermenter<br><b>Fermentation medium:</b> Constituents of medium like carbon source, nitrogen source, amino acids, vitamins, minerals, water, buffers, antifoam agents, precursors, inhibitors, inducers, alternative sources, and monitoring of different parameters<br><b>Sterilization Concept:</b> Fermentation media, equipment, and air | 08            |
| 2      | <b>Medium optimization</b><br><b>Strains of Industrially important microorganisms</b><br>Desirable characteristics of an industrial strain<br>Principles and methods of primary and secondary screening<br>Inoculum development- Master, working, seed culture<br>Pure culture techniques & strain improvement by mutation, genetic engineering and genetic recombination<br>Preservation & maintenance of industrially important micro-organisms<br>Culture Collection Centers in India                                                                                                                                     | 07            |
| 3      | <b>Types of fermentations:</b> Batch, Continuous and Solid-state fermentation<br><b>Scale Up:</b> Bench Studies, Pilot studies, Industrial scale<br><b>Downstream Processing:</b> Methods, principle, types, examples of fermentations, factors affecting, merits and demerits of large- scale operations<br>1. Filtration, Ultrafiltration, Nano filters   2. Liquid-liquid extraction, solvent extraction   3. Chromatography: Ion exchange, Affinity, Gel filtration<br>4. Distillation   5. Crystallization   6. Drying   7. Reverse Osmosis                                                                             | 08            |
| 4      | <b>Use of computers in fermentation</b><br><b>Qualitative and quantitative assays</b><br>Physicochemical Assays: Gravimetric, spectrophotometric, chromatographic<br>Microbiological Assays: Diffusion assay, turbid metric assay<br>Metabolic Assays: Endpoint, enzymatic assay                                                                                                                                                                                                                                                                                                                                             | 07            |

Reference Books:

1. Comprehensive Biotechnology Volume 3 – Murray Moo- Young
2. Principles of Fermentation Technology-Whittaker
3. Industrial Microbiology- Prescott & Duns
4. Industrial Microbiology- A.H. Patel   5. Industrial Microbiology - Pepler and Perlman

Vivekanand College, Kolhapur (Empowered Autonomous Institute)

B.Sc.- III BIOTECHNOLOGY (OPTIONAL)

**CBCS syllabus with effect from June 2025**

Semester V

**DSE03BIT51 Basics of research methodology for Biotechnology- I**

1. CO. To understand regarding research .
- 2 CO. To aware the students how to write research article.
- 3 CO. To learn about the use of Tools and Techniques of Research Methods.
- 4 CO . To gain knowledge about the Research methodology in Biotechnology.

| Sr.No. | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Total Classes |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1      | What is research? Purpose of research, Classification of research, Fundamentals of research methods, Writing a research proposal, Problem Identification: Review of literature, broadening knowledge base in the specific research area, bringing clarity and focus to the research problem, Writing a research proposal, Writing a research report. Identifying variables: What is a variable? The difference between a concept and a variable, Converting concepts into variables, Types of variable, Types of measurement scale. | 07            |
| 2      | Writing Research Report: Format and style. Review of related literature its implications at various stages of research. (Formulation of research problem, hypothesis, interpretation and discussion of results). Major findings, Conclusions and suggestions. Citation of references and Pribliography                                                                                                                                                                                                                              | 08            |
| 3      | Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism                                                                                                                                                                                                                                                                                            | 07            |
| 4      | Introduction to LMS - Learning Management System<br>Research Methodology in Biotechnology<br>Ultraviolet-visible absorption spectroscopy: Principle, Instrumentation and application.<br>Elementary idea about X-ray crystallography, API- Electrospray and MALDI TOF.                                                                                                                                                                                                                                                              | 08            |

#### Reference Book

1. Kumar R., Research Methodology - A Step-By-Step Guide for Beginners, Pearson Education, Delhi (2006).
2. Montgomery, D. C., Design & Analysis of Experiments, 5th Ed., Wiley India (2007).
3. Kothari, C. R., Research Methodology-Methods and Techniques, 2nd Ed., New Age International, New Delhi

Vivekanand College, Kolhapur (Empowered Autonomous Institute)

B.Sc.- III BIOTECHNOLOGY (OPTIONAL)

CBCS syllabus with effect from June 2025

Semester V

MIN03BIT59- VSC Practical- Basic techniques in Computers and Bioinformatics

| Sr. No. | Content                                                                                                   | Credit |
|---------|-----------------------------------------------------------------------------------------------------------|--------|
| 1       | Study of hardware of computer system                                                                      |        |
| 2       | Study of software of computer system                                                                      |        |
| 3       | Prepare resume- in MS word by using features of MS word                                                   |        |
| 4       | MS- Excel- Use different features of MS Excel for data formatting                                         |        |
| 5       | MS- PowerPoint – Prepare presentation on – Artificial intelligence, Cognitive computing, Machine learning |        |
| 6.      | MS- PowerPoint -Study animation effect                                                                    |        |
| 7       | Biological database                                                                                       |        |
| 8.      | DNA sequence analysis tool- BLAST                                                                         |        |
| 9       | Human genome project                                                                                      |        |
| 10      | Browsing NCBI and NLM                                                                                     |        |
| 11      | Sequence alignment tool- Clustal-X                                                                        |        |
| 12      | RNA sequence analysis tool- Clustal                                                                       |        |
| 13      | Introduction of literature database Pubmed                                                                |        |
| 14      | Protein structure exploring database – PDB- Rasmol 3D structure protein analysis                          |        |
| 15      | Phylogenetic tree construction –Clustal W, Philip                                                         |        |
| 16      | Demonstration of thermocycler                                                                             |        |

FPR03BIT51- Field Project

**SEM-V DSC03BIT59- DSC Practical- Biotechnology Lab. -5**

| S.N. | Techniques in Biochemical techniques                                                              | Classes |
|------|---------------------------------------------------------------------------------------------------|---------|
| 1    | Purification of protein by gel filtration chromatography                                          |         |
| 2    | Purification of protein by ion exchange chromatography                                            |         |
| 3    | Estimation of alcohol by potassium dichromate method                                              |         |
| 4    | Alcohol estimation by Specific gravity bottle                                                     |         |
| 5    | Estimation of citric acid from lemon juice                                                        |         |
| 6    | Immobilization of inverses by using sodium alginate, study of inverses activity by DNSA method    |         |
|      | <b>Techniques in Environmental Biotechnology</b>                                                  |         |
| 7    | Determination of BOD                                                                              |         |
| 8    | Determination of COD                                                                              |         |
| 9    | Isolation of <i>Rhizobium</i> from root nodules                                                   |         |
| 10   | Isolation of <i>Azotobacter</i> from soil                                                         |         |
| 11   | Isolation of Phosphate Solubilizing Bacteria (PSB) from soil                                      |         |
| 12   | Determination of hardness of water                                                                |         |
| 13   | Determination of the oligodynamic effect of copper on pathogen                                    |         |
| 14   | Determination of total dissolved solid from waste water sample                                    |         |
|      | <b>Techniques in plant tissue culture</b>                                                         |         |
| 15   | Laboratory Organization and general techniques in PTC                                             |         |
| 16   | Preparation of MS media, stock solution and medium                                                |         |
| 17   | Aseptic seed germination                                                                          |         |
| 18   | Micropropagation stage I- Initiation of micropropagation Shoot tip culture, auxiliary bud culture |         |
| 19   | Micropropagation stage II- structure and multiplication of culture                                |         |
| 20   | Callus culture techniques- Initiation of culture and callus morphology                            |         |
| 21   | Suspension culture technique- Initiation of culture, growth requirement                           |         |
| 22   | Anther Culture technique                                                                          |         |
|      | <b>Techniques in fermentation technology -1</b>                                                   |         |
| 23   | Screening of Amylase Producers from Soil                                                          |         |
| 24   | Screening of antibiotic Producers from Soil                                                       |         |
| 25   | Isolation of vitamin B12 auxotrophic mutant                                                       |         |
| 26   | Isolation of lactic acid bacteria from fermented food                                             |         |
| 27   | Standard plate count of spoiled cheese                                                            |         |
|      | <b>Techniques in research methodology</b>                                                         |         |
| 28   | Demonstration of SDS –PAGE of protein                                                             |         |
| 29   | Separation of plant pigments by adsorption chromatography                                         |         |
| 30   | Demonstration of MALDITOP                                                                         |         |
| 31   | Demonstration of UV visible spectrophotometer                                                     |         |
| 32   | Demonstration of Soxhlet apparatus                                                                |         |

Vivekanand College, Kolhapur (Empowered Autonomous Institute)

B.Sc.- III BIOTECHNOLOGY (OPTIONAL)

CBCS syllabus with effect from June 2025

Semester V

MIN03BIT51- Plant Tissue Culture

- 1.CO. To gain knowledge regarding basic concepts of plant tissue culture laboratory.
- 2.CO. To acquire knowledge about how to cultivate plant tissues *in vitro*
- 3.CO. To study various types of tissue culture
- 4.CO. Construct to design the commercial plant tissue culture laboratory

| Sr.No. | Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Total Classes |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1      | <b>Concept &amp; Historical Background</b><br>Conventional and Non-conventional methods for crop improvement, Concept of cell theory, Cellular totipotency, Differentiation, Dedifferentiation, Redifferentiation, Regeneration.<br><b>Scope, recent advances &amp; applications of Plant Tissue Culture(PTC)</b><br>Infrastructure & organization of Laboratory, Different work areas, Equipment & Instruments required                                                                                                            | 08            |
| 2      | <b>Media &amp; culture preparation</b> Role of micro & macronutrients, vitamins, amino acid, hormones, activated charcoal and solidifying agents. Culture Conditions - pH, Temperature, Humidity.<br><b>Aseptic Techniques</b> Sterilization of Media, Reagent & Glassware, Surface sterilization of explants<br><b>Application of plant tissue and organ culture</b> - Application in agriculture, application in horticulture and forestry, pharmaceuticals, research, paleobotany, applications in industries, transgenic plants | 07            |
| 3      | <b>Callus Culture, Somatic embryogenesis. Protoplast culture,</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 07            |
| 4      | <b>Pathways for clonal propagation and Organogenesis</b> Introduction, principle, protocol, factors affecting, applications.<br><b>Concept of Soma clonal Variation Concept Protoplast culture</b>                                                                                                                                                                                                                                                                                                                                  | 08            |

Reference Books-

1. Introduction to plant tissue culture-M.K.Razdan
2. Plant tissue culture – Theory & practice- S.S.Bhojwani &M.K.Razdan
3. Crop improvement in biotechnology- H.S.Chawala
4. Plant tissue culture-Kalyankumar Dey
5. Textbook of biotechnology- R.C.Dubey

Vivekanand College, Kolhapur (Empowered Autonomous Institute)

B.Sc.- III BIOTECHNOLOGY (OPTIONAL)

CBCS syllabus with effect from June 2025

**Semester V**  
**DSC03BIT59- DSC Practical- Biotechnology Lab. -5**

| SN | Content                                                                     | Credit |
|----|-----------------------------------------------------------------------------|--------|
| 1  | Laboratory Organization and general techniques in PTC                       |        |
| 2  | Preparation of MS media, stock solution and medium                          |        |
| 3  | Aseptic seed germination                                                    |        |
| 4  | Micropropagation stage I- Initiation of micropropagation Shoot tip culture, |        |
| 5  | Micropropagation stage II- structure and multiplication of culture          |        |
| 6  | Callus culture techniques- Initiation of culture and callus morphology      |        |
| 7  | Suspension culture technique- Initiation of culture, growth requirement     |        |
| 8  | Anther Culture technique                                                    |        |
| 9  | Protoplast isolation                                                        |        |
| 10 | Somatic embryogenesis                                                       |        |
| 11 | Protoplast culture                                                          |        |
| 12 | Auxiliary bud culture                                                       |        |
| 13 | Artificial seed production                                                  |        |

# SEMESTER VI

**CBCS syllabus with effect from June 2025****Semester VI****DSC03BIT61- Gene Technology and Bioinformatics**

- 1.CO: To understand important techniques in gene technology  
 2.CO: To learn about different therapies in gene technology  
 3.CO: To learn about applying Biotechnology in silico i.e. via Bioinformatics  
 4.CO: After completing the course students are eligible to work in molecular diagnostic and Bioinformatics laboratory.

| Sr.No. | Content                                                                                                                                                                                                                                                                                                                                                                                                                        | Total Classes |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1      | <b>DNA fingerprinting</b> – Introduction, Genetic marker, Use of minisatellite and microsatellite, Multilocus and single locus probes, Scheme for DNA fingerprinting and applications                                                                                                                                                                                                                                          | 07            |
| 2      | <b>Gene targeting</b> - Method and application<br><b>Types of gene therapy</b> – Somatic gene Germ line<br>Methods of genetransfer (Virus vector, non-viral approach<br>Limitation<br><b>Antisense therapy</b> - Introduction, Principle, Application                                                                                                                                                                          | 07            |
| 3      | <b>Bioinformatics</b><br><b>Computer use in Biology</b> - Internet, Networking- HTTP,HTML, WAN , LAN, MAN<br><b>Information resource</b> - National Center for Biotechnology Information (NCBI), European Bioinformatics Institute (EBI), Sequence retrieval system- Entrez, DBGet<br><b>Genomics</b> - Human Genome Project- Goal, Application, Introduction to nucleic acid database- Gene Bank, EMBL , DDBJ                 | 08            |
| 4      | <b>Introduction to Proteomics, Primary protein sequence database</b> – SWISS-PROT, PIR, MIPS, NRL-3D, TrEMBL<br><b>Introduction to secondary protein sequence database</b> - PROSITE, PROFILE, PRINT, Pfam, BLOCK, IDENTITY<br><b>Other databases</b> - Literature database, Pub Med<br><b>Introduction to structural database</b> - Protein databank (PDB) ,<br><b>Introduction to Molecular docking , Homology modelling</b> | 08            |

## Reference Books-

1. Practical Biochemistry principles and techniques – Wilson and Walkar
2. .Biotechnology -S.N.Jogdan
3. Introduction to Bioinformatics – Rastogi.
4. Introduction to Bioinformatics- T. K. Attwood
5. .Gene Manipulation – Old and Primrose



1. CO. To understand need of animal tissue culture
- 2.CO. To learn about the cultivation of animal tissues *in vitro*
- 3.CO. To gain knowledge about how to prepare and maintain animal tissues using various media and hormones
- 4.CO. Construct to design the commercial Animal tissue culture Laboratory

| Sr.No. | Content                                                                                                                                                                                                                                                                                                                                                                                                            | Total Classes |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1      | <b>Historical Background-</b><br>Landmarks in Animal Tissue Culture<br>Scope, recent advances & applications of ATC<br><b>Overview of ATC Lab Infrastructure-</b> , Substrate for cell growth, equipment required for animal cell culture (Laminar air flow, CO <sub>2</sub> incubator, Centrifuge, Inverted microscope).                                                                                          | 07            |
| 2      | <b>Sterilization Glassware, Equipment &amp; culture media</b><br>Glassware sterilization, reagent and media, sterility testing<br><b>Culture media</b><br>Natural media, synthetic media (serum-containing media, serum free media, balanced salt solution, media constituent, complete culture media, physicochemical properties of media).                                                                       | 08            |
| 3      | <b>Conceptual Background</b><br>Biology and Characterization- Characteristics of cultured cells, cell adhesion, cell proliferation, cell differentiation, metabolism of cultured cells, Initiation of cell culture, Evolution and development of cell lines.<br>Caryotyping.                                                                                                                                       | 07            |
| 4      | <b>Basic technique of mammalian cell culture</b><br>Isolation of tissue, disaggregation of tissue, measurement of viability, primary cell culture, Cell lines, Maintenance of cell culture, Subculture, Stem cell cultures.<br>Scale up in monolayer- Roller bottle culture, Spinner Culture, Micro carrier culture<br><b>Organ and Histolytic Culture:</b> Types and maintenance of organ and histotypic culture, | 08            |

## Reference Books-

1. Textbook of biotechnology- R.C.Dubey
2. Biotechnology- B.D.Singh    3. Animal cell culture- Fresheny.
4. Biotechnology- U.Sattanarayan    5. Principles and practice of Animal tissue culture – Sudha Gangal

## DSC03BIT63 - Fundamentals of cell metabolism and Virology

1.CO: To acquire knowledge regarding biomolecules and their metabolism

2.CO: To learn about various metabolic pathways

3.CO: To understand the basics of viruses their structure, reproduction, and cultivation

4.CO: To study different virus cultivation techniques

| Sr.No. | Content                                                                                                                                                                                                                                                                                                                                                                                                               | Total Classes |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1      | General Metabolism- Introduction, Definition, Reactions of Metabolic Pathways. Methods for the study of Metabolic Pathways by using radioisotopes, by using mutants, and <i>in vitro</i> studies.<br><b>Metabolism of Carbohydrates</b><br>Carbohydrate metabolism- Reactions, Energetics Significance. – Glycolysis Pentose Phosphate Pathway of TCA Cycle.                                                          | 07            |
| 2      | <b>Lipid Metabolism</b><br>Biosynthesis of Saturated Fatty acid Palmitic Acid<br>2 $\beta$ -Oxidation of Fatty acid - Palmitic Acid<br><b>Respiratory Electron Transport Chain</b><br>Component of ETC<br>Mechanism of ATP generation – Chemical coupling hypothesis, Chemiosmotic hypothesis.                                                                                                                        | 08            |
| 3      | <b>Protein and Nucleotide Metabolism.</b> Urea cycle<br><b>Purine biosynthesis ( Denovo and Salvage pathway)</b><br>Purine degradation Pyrimidine biosynthesis<br>Pyrimidine degradation Regulation of purine and pyrimidine metabolism                                                                                                                                                                               | 07            |
| 4      | <b>Virology-</b><br>Introduction, Types of viruses on the basis of Host & type of Nucleic acid General Characteristics of Viruses.<br><b>General Structures of Viruses-</b> TMV, Adenovirus, T4 Bacteriophage-<br><b>Reproduction of viruses-</b> .1- Adeno virus .2- Bacteriophages- T4, 3. $\lambda$ - Phage<br><b>Isolation &amp; Cultivation of Plant &amp; Animal Viruses-</b> Tissue Culture & Embryonated Eggs | 08            |

## Reference

1. Fundamentals of Biochemistry- J.L.Jain
2. Principles of Biochemistry- Lehniger
3. Virology – Lureia DELburk
4. Biochemistry – U.Sattyanaraya

## DSE03BIT61- Fermentation technology II

- 1.CO. To understand various types of fermentation
- 2.CO. To learn about different fermentation product
- 3.CO. To learn about Intellect Property Rights and patenting
- 4 CO: After completing for the course students are eligible to work in the production department in the fermentation industry

| Sr.No. | Content                                                                                                                                                                                                                                                         | Total Classes |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1      | <b>Production of primary metabolites</b><br>Organic acid- Citric Acid, Lactic acid<br>Amino acid- L lysine<br>Enzyme- Asparaginase, amylase<br><b>Production of secondary metabolites</b><br>Antibiotics- Penicillin, Streptomycin                              | 07            |
| 2      | <b>Production of fermented foods</b><br>Cheese Vinegar Beer Red wine Bread<br>Mushroom cultivation<br><b>Microbial biomass production</b><br>Probiotics SCP- <i>Spirulina</i>                                                                                   | 08            |
| 3      | <b>Production of Recombinant-products:</b><br>Recombinant and synthetic vaccines, Growth hormones. Insulin<br><b>Intellectual Property Rights:</b> Introduction Patents: Introduction, criteria, and process of patenting, trademark, trade secrets, copyrights | 07            |
| 4      | Fermentation economics<br>Introduction to Good Manufacturing Practices (GMP)<br>Introduction to Quality Control (QC) and Quality Assurance<br>(QA) Introduction to Biosafety Levels (BSL) I, II, III                                                            | 08            |

## Reference Books:

1. Comprehensive Biotechnology Volume 3 – Murray Moo- Young
- 2 Basic Biotechnology - Colin Ratledge & Bijon Kritinsen
3. Industrial Microbiology – Casida
4. Principles of Fermentation Technology-Whittaker
5. Industrial Microbiology- Prescott & Duns
6. Industrial Microbiology- A.H. Patel
7. Industrial Microbiology - Pepler and Perlman

**DSE03BIT61- Stem cell technology**

CO:1. students get knowledge about Stem cell types ,mechanism of self renewal and differentiation.

CO:2. After completing the course students can understand the use of stem cell research and its potential implications .

CO:3. Students can develop analytical and critical thinking skills to design , conduct and analyze experiments in stem cell research .

CO: 4. students will be able to prepare for careers in stem cell research , biotechnology or related fields such as research scientists ,corporate professionals ,or healthcare professionals

| Sr.No. | Content                                                                                                                                                                                                                                                                                                 | Total Classes |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1      | Stem cells-Introduction Definition and basics of stem cells<br>Classification of stem cells different types of stem cells human embryonic stem cells, adult stem cells etc.<br>Sources of Stem cells Fetus and various adult tissues.-<br>Advantages of stem cells                                      | 07            |
| 2      | Blastocyst culture – various stages of embryonic development. In vitro fertilization<br>Xeno-free derivation of stem cells- Alternative feeder cells and feeder free culture                                                                                                                            | 07            |
| 3      | Cryopreservation of stem cells- Conventional slow-freezing method and vitrification method. Properties of stem cells self renewal, clonality and plasticity.-<br>Pluripotent nature of stem cells- Extrinsic and Intrinsic factors.<br>Cellular models to study pluripotent nature of stem cells        | 08            |
| 4      | Characterization of human embryonic stem cells- expression of cell surface marker, karyotyping etc. Stem cells and their developmental potential Characteristics of stem cells- transdifferentiation of stem cells. Controlled differentiation of human embryonic stem cells, Application of stem cells | 08            |

**Reference Books-**

3. Practical Biochemistry principles and techniques – Wilson and Walkar
4. Protein purification –Robert Scoop
5. Biophysical Chemistry –Nath Upadhyay
4. Textbook of Biotechnology- R.C.Dubey
5. Textbook of Biotechnology- B.D.Singh

VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS INSTITUTE)

B.Sc.- III BIOTECHNOLOGY (OPTIONAL)

CBCS syllabus with effect from June 2025

Semester VI

VSC Practical- MIN03BIT61 ENTERPRENERSHIP

| S.N. | Content                                                                                                                                                                                             | Total<br>class |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 1    | Meaning and Features of a successful Entrepreneurship.                                                                                                                                              |                |
| 2    | Factors influencing entrepreneurship                                                                                                                                                                |                |
| 3    | Forms of Business Organization, Project Identification,<br>Selection of the product.                                                                                                                |                |
| 4    | Project formulation, Assessment of project feasibility.                                                                                                                                             |                |
| 5    | Importance of finance / loans and repayments, Characteristics of<br>Business finance, Fixed capital management: Sources of fixed<br>capital, working capital its sources and how to move for loans, |                |
| 6.   | Marketing-mix, product management – Product line, Product mix,<br>stages of product life cycle, marketing Research and Importance of<br>survey,                                                     |                |
| 7    | Project report preparation.                                                                                                                                                                         |                |

OJT03BIT61- On Job training

| S.N. | <b>Techniques in Gene technology and Bioinformatics</b>                                                                    | T.C. |
|------|----------------------------------------------------------------------------------------------------------------------------|------|
| 1    | Determination of molecular weight of DNA                                                                                   |      |
| 2    | Transformation of <i>E. coli</i>                                                                                           |      |
| 3    | Browsing and understanding of NCBI web page Introduction of literature database - Pubmed                                   |      |
| 4    | Demonstration of thermocycler                                                                                              |      |
| 5    | Protein structure exploring database – Protein Data Bank (PDB) and use of Rasmol to three dimensional structure of protein |      |
| 6    | Study of Human genome project                                                                                              |      |
| 7    | Study of restriction fragment length polymorphism (RFLP)                                                                   |      |
| 8    | Study of Random Amplified Polymorphic DNA                                                                                  |      |
| 9    | Extraction of RNA sequence                                                                                                 |      |
| 10   | Calculate molecular weight and isoelectric point (PI/MW)                                                                   |      |
|      | <b>Techniques in Metabolism and Virology</b>                                                                               |      |
| 11   | Isolation of coli phages                                                                                                   |      |
| 12   | ELISA (Enzyme-Linked Immunosorbent Assay): Detecting <b>viral</b> antigens or antibodies.                                  |      |
| 13   | <b>Viral Genetics: 1. Sequencing: Determining the nucleotide sequence of viral gen.</b>                                    |      |
| 14   | Extraction of total lipid from egg yolk                                                                                    |      |
| 15   | Estimate blood glucose level by GOD-POD method                                                                             |      |
| 16   | Study of sugar fermentation by microorganisms                                                                              |      |
| 17   | Isolation and fractionation of egg lipids by tlc                                                                           |      |
|      | <b>Techniques in Animal tissue culture</b>                                                                                 |      |
| 18   | ATC laboratory design and equipment used in ATC                                                                            |      |
| 19   | Animal cell culture media preparation of media                                                                             |      |
| 20   | Study of sterilization techniques in animal tissue culture                                                                 |      |
| 21   | Preparation of sera                                                                                                        |      |
| 22   | Cell counting and viability                                                                                                |      |
| 23   | DPPH radical scavenging assay                                                                                              |      |
| 24   | Animal handling and care                                                                                                   |      |
| 25   | Culture of virus in chick embryo                                                                                           |      |
|      | <b>Techniques in Fermentation technology -2</b>                                                                            |      |
| 26   | Penicillin bioassay                                                                                                        |      |
| 27   | Vitamin Bioassay                                                                                                           |      |
| 28   | Amylase production by Koji fermentation                                                                                    |      |
| 29   | Wine production from fruit                                                                                                 |      |
| 30   | Production of bioethanol                                                                                                   |      |
|      | <b>Stem cell technology</b>                                                                                                |      |
| 31   | Stem cell banking concept                                                                                                  |      |
| 32   | Demonstration of forms of stem cell                                                                                        |      |
| 33   | Cell surface marker analysis                                                                                               |      |
| 34   | Demonstration of Bone marrow transplantation                                                                               |      |

1. CO. To understand need of animal tissue culture
- 2.CO. To learn about the cultivation of animal tissues *in vitro*
- 3.CO. To gain knowledge about how to prepare and maintain animal tissues using various media and hormones
- 4.CO. Construct to design the commercial Animal tissue culture Laboratory

| Sr.No. | Content                                                                                                                                                                                                                                                                                                                                                  | Total Classes |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1      | <b>Historical Background-</b><br>Landmarks in Animal Tissue Culture<br>Scope, recent advances & applications of ATC<br><b>Overview of ATC Lab Infrastructure-</b> Substrate for cell growth, equipment required for animal cell culture (Laminar air flow, CO <sub>2</sub> incubator, Centrifuge, Inverted microscope).                                  | 08            |
| 2      | <b>Sterilization Glassware, Equipment &amp; culture media</b> Glassware sterilization, reagent and media sterilization, sterility testing.<br><b>Culture media</b><br>Natural media, synthetic media (serum-containing media, serum free media, balanced salt solution, media constituent, complete culture media, physicochemical properties of media). | 07            |
| 3      | <b>Conceptual Background</b><br>Biology and Characterization- Characteristics of cultured cells, cell adhesion, cell proliferation, cell differentiation, metabolism of cultured cells, Initiation of cell culture, Evolution and development of cell lines                                                                                              | 08            |
| 4      | <b>Basic technique of mammalian cell culture</b><br>Isolation of tissue, disaggregation of tissue, measurement of viability, primary cell culture, Cell lines, Maintenance of cell culture, Subculture, Stem cell cultures. Scale up in monolayer- Roller bottle culture, Spinner Culture, Microcarrier culture                                          | 07            |

Reference Books-

1. Introduction to plant tissue culture-M.K.Razdan
2. Plant tissue culture – Theory & practice- S.S.Bhojwani & M.K.Razdan
3. Crop improvement in biotechnology- H.S.Chawala
4. Plant tissue culture-Kalyankumar Dey
5. Textbook of biotechnology- R.C.Dubey

| S.N. | Content                                                    | T.C. |
|------|------------------------------------------------------------|------|
| 1    | Animal Tissue Culture laboratory design                    |      |
| 2    | Animal cell culture equipment                              |      |
| 3    | Study of sterilization techniques in animal tissue culture |      |
| 4    | Animal tissue culture media preparation                    |      |
| 5    | Cell counting and viability                                |      |
| 6    | ABTS assay                                                 |      |
| 7    | Animal handling and care                                   |      |
| 8    | Staining of animal cell                                    |      |
| 9    | Preservation of cell lines                                 |      |
| 10   | Preparation of established cell line                       |      |
| 11   | Primary cell culture                                       |      |
| 12   | Adaptation of viruses in animal cell culture               |      |



## NATURE OF THEORY QUESTION PAPER AND DISTRIBUTION OF MARKS

### Instruction : Nature of Question Paper (Theory)

1. All the questions are compulsory.
2. Figures to the right indicates full marks.
3. Draw neat labelled diagram wherever necessary.

**Time: 2Hrs**

**Total Marks: 40**

**Q. 1. Choose the correct alternative and rewrite the sentences.**

**(8Marks)**

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 Marks)**

- i.
- ii.
- iii..

**Q. 3. Attempt any four out of six**

**(16 Marks)**

- i.
- ii.
- iii..
- iv.
- v.
- vi

**Instructions to paper setters :** Equal weightage should be given to all units.

**For Continues Internal Evaluation : (10 Marks) each subject**

Shri Swami Vivekanand Shikshan Sanstha's  
Vivekanand College, Kolhapur (An Empowered Autonomous Institute)  
B.Sc. Part- III (Biotechnology Optional)  
Semester- V/VI Practical Skeletal Question  
Paper Practical base on DSC, DSE, VSC

**NATURE OF PRACTICAL QUESTION PAPER AND DISTRIBUTION OF MARKS DSC DSE**

|                               |                             |              |
|-------------------------------|-----------------------------|--------------|
| Q.1 Major Experiment<br>(30M) | (Each experiment with 15M)  | 2 Experiment |
| Q.2 Minor experiment<br>(20M) | (Each experiment with 10M)  | 2 Experiment |
| Q.3 Spotting 10<br>(10M)      | (Each spot contain 2 marks) | 5 Spots      |
| Q.4 journal 5<br>(10 M)       | (Certified journal DSC DSE) |              |
| Q.5 Seminar 10<br>(10M)       |                             |              |

---

Total -75

**NATURE OF PRACTICAL QUESTION PAPER AND DISTRIBUTION OF MARKS VSC**

|            |                   |            |
|------------|-------------------|------------|
| <b>Q.1</b> | <b>Experiment</b> | <b>10M</b> |
| <b>Q.2</b> | <b>Experiment</b> | <b>10M</b> |
| <b>Q.3</b> | <b>Journal</b>    | <b>05M</b> |





