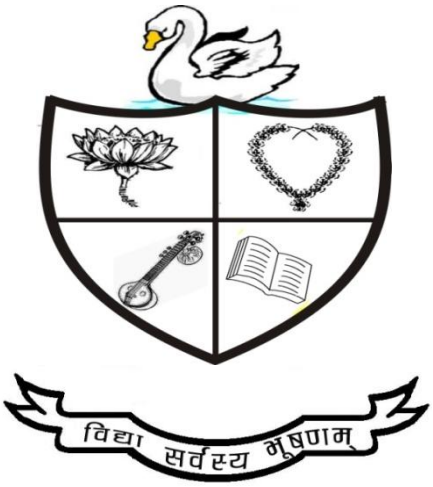
# SYLLABUS FOR

# THE FOUR-YEAR UNDERGRADUATE PROGRAMME (FYUGP)

As per provisions of NEP_2020 to be implemented from academic year 2022 onwards.

| | |
|---|---|
| Semester: **IV** | Session: **2025-26** |
| Course Type: **DSC** | Title: **Recombinant DNA technology** |




## Department of Biotechnology

GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE COLLEGE, RAJNANDGAON (C.G.)

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

# FYUGP (NEP 2020 Course)

**Department: Biotechnology**

| **Part A: Introduction** | | | |
|---|---|---|---|
| Program: Bachelor in Life Sciences (Diploma/Degree/Honors) | | Semester: **IV Sem** | Session:**2025-26** |
| 1 | Course Code | **BTSC-04-T** | |
| 2 | Course Title | **Recombinant DNA technology** | |
| 3 | Course Type | Core Course | |
| 4 | Pre-requisite (if any) | As per program | |
| 6 | Course Learning Outcomes (CLO) | After completing this course, the students will be able to -<br>• Understand various tools of genetic engineering.<br>• Develop competency in genetic exploitation for human welfare.<br>• Understand the practical application of recombinant DNA technology.<br>• Understand the use of information technology in the field of genome and proteome analysis. | |
| 6 | Credit Value | 03 Credits (Credit = 15 Hours - learning & observation) | |
| 7 | Total Marks | Max. Marks: 100 | Min Passing Marks: 40 |

| **Part B: Content of Course (Theory)** | | |
|---|---|---|
| Total No. of Teaching–learning Periods (01 Hr. per period)- 45 Periods (45 Hours) | | |
| Unit | Topic (Course content) | No. of Period |
| I | **Prerequisites of rDNA technology**<br>1. Recombinant DNA technology: General concept. Steps and application.<br>2. Host controlled Restriction Modification System, Ligases and Polymerases, Klenow fragment, Taq, Pfu polymerase.<br>3. Nuclease (Endo, Exo, and restriction endonuclease).<br>4. Modification Enzyme (Kinase, Phosphates and terminal deoxynucleotidyltransferase), Reverse Transcriptase. | 12 (12 Hrs) |
| II | **Gene transfer**<br>1. Vectors: Based on Plasmid, Bacteriophages, Cosmid.<br>2. High capacity vectors.<br>3. The basic concept of Gene Transfer Methods: Microinjection, Electroporation, Lipofection, and Microprojectile.<br>4. Selection and Screening of Recombinants: Genetic and Hybridization methods. | 11 (11 Hrs) |
| III | **Genomic validation**<br>1. PCR: Types of PCR, Steps, Applications, Advantages and Limitations of PCR.<br>2. Molecular Marker-RFLP, RAPD, and Microarray.<br>3. Human Genome Project.<br>4. Gene Library: Genomic and cDNA library, Chromosome walking and jumping. | 11 (11 Hrs) |
| IV | **Application of genetic technology**<br>1. Gene Therapy: *In vivo* and *Ex vivo*, germline and somatic gene therapy.<br>2. Basic idea of stem cell technology: Types of stem cell cultures and their | 11 (11 Hrs) |

| | | |
|---|---|---|
| | Significance.<br>3. Introduction to Genomics, DNA sequencing methods – manual & automated: Maxam & Gilbert and Sangers method.<br>4. Introduction to protein structure, Chemical properties of proteins, physical interactions that determine the property of proteins, short-range interactions, electrostatic forces, van der Waal interactions, hydrogen bonds, and Hydrophobic interactions. | |
| Keywords | Recombinant DNA, Vectors, PCR, cDNA library. | |

| • Part C - **Learning Resource** |
|---|
| **Text Books, Reference Books, Other Resources -** |
| **Text Book-**<br>➢ **P S Verma and A K Agrawal**<br>➢ **An introduction to genetic engineering- S T Tischoll** |
| • Molecular Biology; Watson.<br>• Gene VIII; Benjamin Lewin.<br>• The Cell, A molecular Approach; Geoffrey M. Cooper.<br>• Molecular Biology of the Cell; Alberts<br>• Modern Biotechnology, 2nd Edition, S.B. Primrose, Blackwell Publishing, 1987.<br>• Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4th Edition, B.R. Glick, J.J. Pasternak and C.L. Patten, 2010.<br>• Molecular Cloning: A Laboratory Manual (3rd Edition) Sambrook and Russell Vol. I<br>• Principles of Gene Manipulation 6th Edition, S.B.Primrose, R.M.Twyman and R.W. Old. Blackwell Science, 2001. |
| • Online resources- https://onlinecourses.swayam2.ac.in/cec21_bt05/preview<br>• https://archive.nptel.ac.in/courses/102/104/102104052/ |

| **Part** D: **Assessment and Evaluation** | | |
|---|---|---|
| **Suggested Continuous Evaluation Methods:**<br>**Maximum Marks: 100 Marks**<br>**Continuous Internal Assessment (CIA): 30 Marks**<br>**End Semester Exam (ESE): 70 Marks** | | |
| **Continuous Internal Assessment (CIA) (By course teacher):** | Internal Test / Quiz-(2): **20 +20**<br>Assignment / Seminar - **10**<br>Total Marks - **30** | Better marks out of the two Test / Quiz **+** obtained marks in Assignment shall be considered against **30** Marks |
| **End Semester Exam (ESE):** | **Two section – A & B**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks**<br>Section B: Descriptive answer type qts.,**1 out of 2** from each unit- **4x10=40 Marks** | |

**Approval of the Board of Studies**

Date: 14/05/25

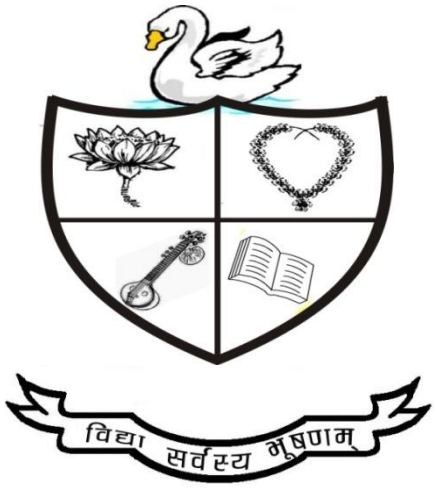
| Name | Prof. S. K. Jadhav | Sabiha Naz | Dr. Shubha Diwan | Shri Sanjay Bhagwat | Ku. Varsha Meshram | Dr. Pramod Kumar Mahish |
|---|---|---|---|---|---|---|
| Designation | VC Nominee | Subject Expert | Subject Expert | Employment/ Industrial Member | Merit Alumni | Chairman/ HOD |
| Signature | | | Joined online | Joined online | | |

# SYLLABUS FOR

# THE FOUR-YEAR UNDERGRADUATE PROGRAMME (FYUGP)

As per provisions of NEP_2020 to be implemented from academic year 2022 onwards.

| | |
|---|---|
| Semester: **IV** | Session: **2025-26** |
| Course Type: **DSC Practical** | Title: **Recombinant DNA technology** |




## Department of Biotechnology

GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE COLLEGE, RAJNANDGAON (C.G.)

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

# FYUGP (NEP 2020 Course)

**Department: Biotechnology**

**Four Year Undergraduate Program (2024-28)**
**Department of Biotechnology**
**Course Curriculum**

| **Part A: Introduction** | | | |
|---|---|---|---|
| Program: Bachelor in Life Sciences (Diploma/Degree/Honors) | | Semester: **IV Sem** | Session:**2025-26** |
| 1 | Course Code | **BTSC-04-P** | |
| 2 | Course Title | **Recombinant DNA technology** | |
| 3 | Course Type | Core Course | |
| 4 | Pre-requisite (if any) | As per program | |
| 6 | Course Learning Outcomes (CLO) | After completing this course, the students will be able to -<br>• Isolate nucleic acid from biological cells.<br>• Estimate and manipulate nucleic acid.<br>• Amplify nucleic acid.<br>• Analyse nucleic acid on the basis of database. | |
| 6 | Credit Value | 01 Credits Credit =30 Hours Laboratory or Field learning/Training | |
| 7 | Total Marks | Max. Marks: 50 | Min Passing Marks: 20 |

| **Part B: Content of Course** | | |
|---|---|---|
| Total No. of learning-Training/performance Periods: 30 Periods (30 Hours) | | |
| Module | Topic (Course content) | No. of Period |
| Lab./Field Training/ Experiment Contents of Course | 5. Isolation of chromosomal DNA from plant cells<br>6. Isolation of chromosomal DNA from *E.coli*<br>7. Qualitative and quantitative analysis of DNA using spectrophotometer<br>8. Plasmid DNA isolation<br>9. Restriction digestion of DNA.<br>10. Ligation of DNA.<br>11. Transformation of competent cells.<br>12. Demonstration of PCR.<br>13. Use of SNP databases at NCBI and other sites.<br>14. Use of OMIM database<br>15. Detection of Open Reading Frames using ORF Finder | 30 |
| Keywords | Recombinant DNA, Vectors, PCR, cDNA library. | |

| • Part C - **Learning Resource** |
|---|
| **Text Books, Reference Books, Other Resources -** |
| **Text Book-**<br>➢ **P S Verma and A K Agrawal**<br>➢ **An introduction to genetic engineering- S T Tischoll** |
| • Molecular Biology; Watson. |

- Gene VIII; Benjamin Lewin.
- The Cell, A molecular Approach; Geoffrey M. Cooper.
- Molecular Biology of the Cell; Alberts
- Modern Biotechnology, 2nd Edition, S.B. Primrose, Blackwell Publishing, 1987.
- Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4th Edition, B.R. Glick, J.J. Pasternak and C.L. Patten, 2010.
- Molecular Cloning: A Laboratory Manual (3rd Edition) Sambrook and Russell Vol. I to III, 1989.
- Principles of Gene Manipulation 6th Edition, S.B.Primrose, R.M.Twyman and R.W. Old. Blackwell Science, 2001.


- Online resources- https://onlinecourses.swayam2.ac.in/cec21_bt05/preview
- https://archive.nptel.ac.in/courses/102/104/102104052/
-

| **Part** D: **Assessment and Evaluation** | | |
|---|---|---|
| **Suggested Continuous Evaluation Methods:**<br>**Maximum Marks: 50 Marks**<br>**Continuous Internal Assessment (CIA): 15 Marks**<br>**End Semester Exam (ESE): 35 Marks** | | |
| **Continuous Internal Assessment (CIA) (By course teacher):** | Internal Test / Quiz-(2): **10 +10**<br>Assignment / Seminar + Attendance- 05<br>Total Marks - **15** | Better marks out of the two Test / Quiz **+** obtained marks in Assignment shall be considered against **15** Marks |
| **End Semester Exam (ESE):** | **Laboratory / Field Skill Performance:**<br>**A. On spot Assessment - 20 Marks**<br>**B. Spotting based on tools & technology (written) – 10 Marks**<br>**C. Viva-voce (based on principle/technology) - 05 Marks** | Managed by course teacher as per lab status |

**Approval of the Board of Studies**

Date: 14/05/25

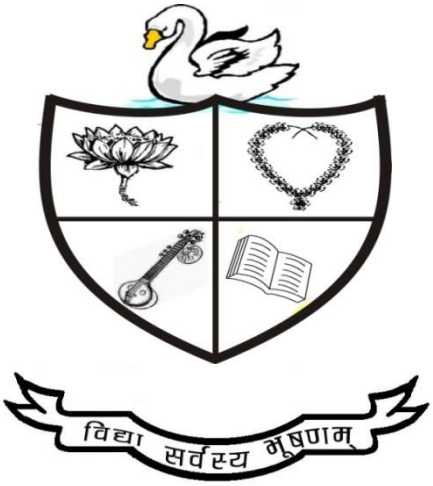
| Name | Prof. S. K. Jadhav | Sabiha Naz | Dr. Shubha Diwan | Shri Sanjay Bhagwat | Ku. Varsha Meshram | Dr. Pramod Kumar Mahish |
|---|---|---|---|---|---|---|
| Designation | VC Nominee | Subject Expert | Subject Expert | Employment/ Industrial Member | Merit Alumni | Chairman/ HOD |
| Signature | | | Joined online | Joined online | | |

# SYLLABUS FOR

# THE FOUR-YEAR UNDERGRADUATE PROGRAMME (FYUGP)

As per provisions of NEP_2020 to be implemented from academic year 2022 onwards.

| | |
|---|---|
| Semester: **IV** | Session: **2025-26** |
| Course Type: **DSE** | Title: **Bioprocess Engineering** |




## Department of Biotechnology

GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE COLLEGE, RAJNANDGAON (C.G.)

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

# FYUGP (NEP 2020 Course)

**Department: Biotechnology**

**Course Curriculum**

| **Part A: Introduction** | | | |
|---|---|---|---|
| Program: Bachelor in Life Sciences (Degree/Honors) | | Semester: **IV Sem** | Session:**2025-26** |
| 1 | Course Code | **BTSE-02-T** | |
| 2 | Course Title | **Bioprocess Engineering** | |
| 3 | Course Type | Elective course | |
| 4 | Pre-requisite (if any) | As per program | |
| 5 | Course Learning Outcomes (CLO) | After completing this course, the students will be able to -<br>• Understand the prerequisite of bioprocess engineering.<br>• Develop skills for the operation of bioreactors.<br>• Develop skills for industrial production.<br>• Understand the geological exploitation by the process of bioprocess engineering. | |
| 6 | Credit Value | 03 Credits (Credit = 15 Hours - learning & observation) | |
| 7 | Total Marks | Max. Marks: 100 | Min Passing Marks: 40 |

| **Part B: Content of Course (Theory)** | | |
|---|---|---|
| Total No. of Teaching–learning Periods (01 Hr. per period)- 45 Periods (45 Hours) | | |
| Unit | Topic (Course content) | No. of Period |
| I | **Concept of bioprocess engineering**<br>1. Introduction to bioprocess engineering.<br>2. Isolation, preservation, and maintenance of industrial microorganisms.<br>3. Media for industrial fermentation.<br>4. Kinetics of microbial fermentation. | 12 (12 Hrs) |
| II | **Bioreactors**<br>1. Types of fermentation processes.<br>2. Operations of bioreactors.<br>3. Measurement and control of bioprocess parameters.<br>4. Downstream processing. | 11 (11 hrs) |
| III | **Bioproducts**<br>1. Production of alcohol, acids and solvents.<br>2. Production of antibiotics.<br>3. Production of amino acids.<br>4. Whole cell immobilization for industrial application. | 11 (11 hrs) |
| IV | **Microbial role and regulation**<br>1. Application of microbes in mineral beneficiation.<br>2. Application of microbes for oil recovery.<br>3. Quality control, quality assurance and standard operating procedures of fermenter.<br>4. Good manufacturing practices. | 11 (11 hrs) |
| Keywords | Fermentation, bioreactors, fermentation-based production, mineral beneficiation. | |

| • Part C - **Learning Resource** |
|---|
| **Text Books, Reference Books, Other Resources -** |
| **Text book-** Industrial Biotechnology- D Das<br>• Industrial Microbiology- A.H. Patel. |
| Reference Book-<br>• Wastewater Engineering- Treatment, Disposal & Reuse. Metall and Eddy, Inc., Tata Mcgraw Hill, N. Delhi.<br>• Microbiology- Pelczar&Pelczar.<br>• Environmental Biotechnology, PrathamVashishith. Dominant Publishers And Distributors, N.Delhi.<br>• Principles of Fermentation Technology; Stanburry.<br>• Industrial Microbiology; Casida. |
| Online resources- https://archive.nptel.ac.in/courses/102/105/102105058/<br>http://www.ndl.gov.in/he_document/nptel/downloads_new_lecturenotes_102105058_102105058 |

| **Part** D: **Assessment and Evaluation** | | |
|---|---|---|
| **Suggested Continuous Evaluation Methods:**<br>**Maximum Marks: 100 Marks**<br>**Continuous Internal Assessment (CIA): 30 Marks**<br>**End Semester Exam (ESE): 70 Marks** | | |
| **Continuous Internal Assessment (CIA) (By course teacher):** | Internal Test / Quiz-(2): **20 +20**<br>Assignment / Seminar - **10**<br>Total Marks - **30** | Better marks out of the two Test / Quiz **+** obtained marks in Assignment shall be considered against **30** Marks |
| **End Semester Exam (ESE):** | **Two section – A & B**<br>Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks**<br>Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks** | |

**Approval of the Board of Studies**

**Date:** 14/05/25

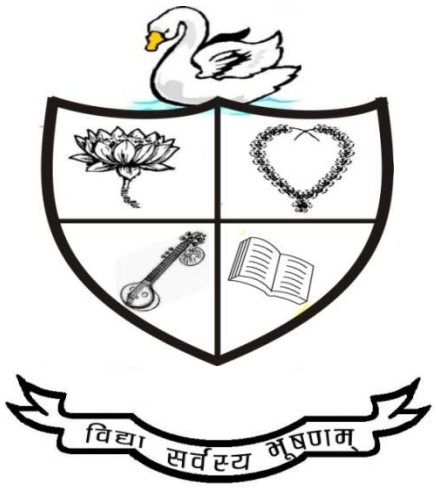
| Name | Prof. S. K. Jadhav | Sabiha Naz | Dr. Shubha Diwan | Shri Sanjay Bhagwat | Ku. Varsha Meshram | Dr. Pramod Kumar Mahish |
|---|---|---|---|---|---|---|
| Designation | VC Nominee | Subject Expert | Subject Expert | Employment/ Industrial Member | Merit Alumni | Chairman/ HOD |
| Signature | | | Joined online | Joined online | | |

# SYLLABUS FOR

# THE FOUR-YEAR UNDERGRADUATE PROGRAMME (FYUGP)

As per provisions of NEP_2020 to be implemented from academic year 2022 onwards.

| | |
|---|---|
| Semester: **IV** | Session: **2025-26** |
| Course Type: **DSE Practical** | Title: **Bioprocess Engineering** |




## Department of Biotechnology

GOVT. DIGVIJAY AUTONOMOUS POST GRADUATE COLLEGE, RAJNANDGAON (C.G.)

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

# FYUGP (NEP 2020 Course)

**Department: Biotechnology**

**Four Year Undergraduate Program (2024-28)**
**Department of Biotechnology**
**Course Curriculum**

| **Part A: Introduction** | | | |
|---|---|---|---|
| Program: Bachelor in Life Sciences (Diploma/Degree/Honors) | | Semester: **IV Sem** | Session:**2025-26** |
| 1 | Course Code | **BTSE-02-P** | |
| 2 | Course Title | **Bioprocess Engineering** | |
| 3 | Course Type | Elective course (Practical) | |
| 4 | Pre-requisite (if any) | As per program | |
| 5 | Course Learning Outcomes (CLO) | After completing this practical course, the students will be able to -<br>• Isolate and maintain industrially significant microbes.<br>• Develop skills for alcoholic production.<br>• Develop skills for acid production.<br>• Develop skills for antibiotic and enzyme production. | |
| 6 | Credit Value | 01 Credits Credit =30 Hours Laboratory or Field learning/Training | |
| 7 | Total Marks | Max. Marks: 50 | Min Passing Marks: 20 |

| **Part B: Content of Course (Theory)** | | |
|---|---|---|
| Total No. of learning-Training/performance Periods: 30 Periods (30 Hours) | | |
| Module | Topic (Course content) | No. of Period |
| Lab./Field Training/ Experiment Contents of Course | 1. Isolation of industrially important microorganisms for microbial process.<br>2. Determination of thermal death point (TDP) and thermal death time (TDT) of microorganisms.<br>3. Comparative studies of ethanol production using different substrates.<br>4. Microbial production of citric acid using *Aspergillus niger.*<br>5. Microbial production of antibiotics *(Penicillin*)<br>6. Production and estimation of alkaline protease. | 30 |
| Keywords | Fermentation, bioreactors, fermentation-based production, mineral beneficiation. | |

- Part C - **Learning Resource**

**Text Books, Reference Books, Other Resources -**

**Text book-** Industrial Biotechnology- D Das

- Industrial Microbiology- A.H. Patel.

Reference Book-

- Wastewater Engineering- Treatment, Disposal & Reuse. Metall and Eddy, Inc., Tata Mcgraw Hill, N. Delhi.
- Microbiology- Pelczar&Pelczar.
- Environmental Biotechnology, PrathamVashishith. Dominant Publishers And Distributors, N.Delhi.

| |
|---|
| • Principles of Fermentation Technology; Stanburry.<br>• Industrial Microbiology; Casida. |
| Online resources- https://archive.nptel.ac.in/courses/102/105/102105058/<br>http://www.ndl.gov.in/he_document/nptel/downloads_new_lecturenotes_102105058_102105058 |

| **Part** D: **Assessment and Evaluation** | | |
|---|---|---|
| **Suggested Continuous Evaluation Methods:**<br>**Maximum Marks: 50 Marks**<br>**Continuous Internal Assessment (CIA): 15 Marks**<br>**End Semester Exam (ESE): 35 Marks** | | |
| **Continuous Internal Assessment (CIA) (By course teacher):** | Internal Test / Quiz-(2): **10 +10**<br>Assignment / Seminar + Attendance- 05<br>Total Marks - **15** | Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks |
| **End Semester Exam (ESE):** | **Laboratory / Field Skill Performance:**<br>**A. On spot Assessment - 20**<br>**B. Spotting based on tools & technology (written) – 10 Marks**<br>**C. Viva-voce (based on principle/technology) - 05 Marks** | Managed by course teacher as per lab status |

**Approval of the Board of Studies**

Date: 14/05/25

| Name | Prof. S. K. Jadhav | Sabiha Naz | Dr. Shubha Diwan | Shri Sanjay Bhagwat | Ku. Varsha Meshram | Dr. Pramod Kumar Mahish |
|---|---|---|---|---|---|---|
| Designation | VC Nominee | Subject Expert | Subject Expert | Employment/ Industrial Member | Merit Alumni | Chairman/ HOD |
| Signature | | | joined online | joined online | | |