

# **CURRICULUM & SYLLABUS**

## **Bachelor of Technology in BIOTECHNOLOGY**

**(Applicable for the Batch of 2024-2028 & 2025-2029)**



### **Haldia Institute of Technology**

***[An Autonomous Institute of ICARE]***

***Approved by: All India Council for Technical Education (AICTE)***

***Affiliated to: Maulana Abul Kalam Azad University of Technology, West  
Bengal (Formerly Known as - WBUT)***

**HIT Campus, ICARE Complex, Purba Medinipur - 721657, WB, India**

## THE INSTITUTE'S VISION AND MISSION

### VISION

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To achieve Centre of Excellence in the field of Science, Technology and Management Education for creating dynamic human resources of global standards with capabilities of accepting new challenges.

### MISSION

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**M1:** To impart quality and value based education to raise satisfaction level of all stakeholders.

**M2:** To create competent, creative professionals, and great entrepreneurs who can work as individual or in group in multi-cultural global environments.

**M3:** To prepare citizens who would grow to be competent enough to contribute significantly with personal integrity and civic responsibility for the betterment of mankind throughout their careers and profession.

## **VISION AND MISSION OF THE DEPARTMENT (BIOTECHNOLOGY)**

### **VISION**

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To evolve as a pioneer to combat biological challenges and to develop students with sound concepts in Biotechnology who can excel as Leaders in the field of Research, Entrepreneurship, Industry and Management.

### **MISSION**

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**M1:** Implementation of outcome based teaching-learning methodology to fulfil current emerging challenges in various areas of Biotechnology.

**M2:** To fill up the gap between theory and practical in tune with the challenging demands of Biotechnology based industry and academia.

**M3:** To emphasize on certain areas such as soft skills, ethics, team spirit, environmental and societal issues for overall development.

## **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)**

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**PEO 1: Creating Outcome Based Education in Biotechnology:** To imbibe outcome based basic education of Biotechnology for the students to help them excel in all related fields with competence, technical knowledge and analytical skill.

**PEO 2: Power to Work in Multidisciplinary Arena Bridging the Gap between Knowledge and Application:** To train the students for attainment of multidisciplinary technical skills and modern technology to serve as an individual or as a leader with effective communication apt for industry, research & development sectors.

**PEO 3: Competence to Provide Service to the Nation as Well as the Society:** To fulfill the needs of society for solving medical, agricultural and environmental problems using biotechnological principle, tools and practices in an ethical and responsible manner.

## **PROGRAMME SPECIFIC OUTCOMES (PSOs)**

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**PSO 1:** An ability to understand the basic concepts of Biotechnology and its application in various fields.

**PSO 2:** An ability to combine the theoretical and practical knowledge to solve complex biological problems using appropriate analytical skills and modern tools.

**PSO 3:** An ability to build up a successful career compatible in real world with ethical awareness for developing as a working professional or a self-sustaining entrepreneur.

## PROGRAM OUTCOMES (POs)

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**PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

**PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

**PO3: Design / Development of Solutions:** Design creative solutions for complex engineering problems and design / develop systems / components / processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

**PO4: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

**PO5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

**PO6: The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

**PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

**PO8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

**PO9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

**PO10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

**PO11: Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

## CURRICULUM STRUCTURE

### B.TECH 2<sup>ND</sup> YEAR (SEMESTER III)

| Field                                     | Course Code | Course Name                                            | Contact Hours / Week |   |   |       | Credit |
|-------------------------------------------|-------------|--------------------------------------------------------|----------------------|---|---|-------|--------|
|                                           |             |                                                        | L                    | T | P | Total |        |
| Humanities, Social Science and Management | HM-BT301    | Fundamentals of Management for Engineers               | 3                    | 0 | 0 | 3     | 3      |
| Basic Science                             | BS-BT301    | Bioprocess Calculations                                | 3                    | 0 | 0 | 3     | 3      |
| Basic Science                             | BS-BT302    | Biological Thermodynamics and Kinetics                 | 2                    | 0 | 0 | 2     | 2      |
| Professional Core                         | PC-BT301    | Structure of Biomolecules                              | 3                    | 0 | 0 | 3     | 3      |
| Professional Core                         | PC-BT302    | Biochemistry                                           | 3                    | 0 | 0 | 3     | 3      |
| Professional Core                         | PC-BT303    | Microbiology                                           | 3                    | 0 | 0 | 3     | 3      |
| Professional Core                         | PC-BT391    | Biomolecular Analysis Laboratory                       | 0                    | 0 | 2 | 2     | 1      |
| Professional Core                         | PC-BT392    | Biochemistry Laboratory                                | 0                    | 0 | 2 | 2     | 1      |
| Professional Core                         | PC-BT393    | Microbiology Laboratory                                | 0                    | 0 | 2 | 2     | 1      |
| Mandatory Course                          | MC-BT381    | Community Service Towards Environmental Sustainability | 0                    | 0 | 2 | 2     | 0      |
| Total Credit                              |             |                                                        |                      |   |   |       | 20     |

**B.TECH 2<sup>ND</sup> YEAR (SEMESTER IV)**

| Field                 | Course Code | Course Name                                                          | Contact Hours / Week |   |   |       | Credit |
|-----------------------|-------------|----------------------------------------------------------------------|----------------------|---|---|-------|--------|
|                       |             |                                                                      | L                    | T | P | Total |        |
| Engineering Science   | ES-BT401    | Transfer Operation-I                                                 | 3                    | 0 | 0 | 3     | 3      |
| Professional Core     | PC-BT401    | Cell and Molecular Biology                                           | 3                    | 0 | 0 | 3     | 3      |
| Professional Elective | PE-BT401    | Food Biotechnology (PE-BT401A)                                       | 2                    | 0 | 0 | 2     | 2      |
|                       |             | Biostatistics (PE-BT401B)                                            |                      |   |   |       |        |
| Professional Elective | PE-BT402    | Renewable Energy Technology (PE-BT402A)                              | 2                    | 0 | 0 | 2     | 2      |
|                       |             | Environmental Biotechnology (PE-BT402B)                              |                      |   |   |       |        |
|                       |             | Agricultural Biotechnology (PE-BT402C)                               |                      |   |   |       |        |
| Open Elective         | OE-BT401    | Data Structure and Algorithms (OE-BT401A)                            | 3                    | 0 | 0 | 3     | 3      |
|                       |             | Foundations of Data Science for Biotechnology (OE-BT401B)            |                      |   |   |       |        |
|                       |             | Basics of Drug Design and Delivery System (OE-BT401C)                |                      |   |   |       |        |
| Open Elective         | OE-BT402    | Introduction to Python (OE-BT402A)                                   | 3                    | 0 | 0 | 3     | 3      |
|                       |             | Research Methodology (OE-BT402B)                                     |                      |   |   |       |        |
|                       |             | Biosafety (OE-BT402C)                                                |                      |   |   |       |        |
| Engineering Science   | ES-BT491    | Transfer Operation-I Laboratory                                      | 0                    | 0 | 2 | 2     | 1      |
| Professional Core     | PC-BT491    | Cell and Molecular Biology Laboratory                                | 0                    | 0 | 2 | 2     | 1      |
| Professional Elective | PE-BT491    | Food Biotechnology Laboratory (PE-BT491A)                            | 0                    | 0 | 2 | 2     | 1      |
|                       |             | Biostatistics Laboratory (PE-BT491B)                                 |                      |   |   |       |        |
| Open Elective         | OE-BT491    | Data Structure and Algorithms Laboratory (OE-BT491A)                 | 0                    | 0 | 2 | 2     | 1      |
|                       |             | Foundations of Data Science for Biotechnology Laboratory (OE-BT491B) |                      |   |   |       |        |
|                       |             | Drug Design and Delivery Systems Laboratory (OE-BT491C)              |                      |   |   |       |        |
| Total Credit          |             |                                                                      |                      |   |   |       | 20     |

Total credit in 2<sup>nd</sup> year 40

**B.TECH 3<sup>RD</sup> YEAR (SEMESTER V)**

| Field                                     | Course Code | Course Name                                                                | Contact Hours / Week |   |   |       | Credit |
|-------------------------------------------|-------------|----------------------------------------------------------------------------|----------------------|---|---|-------|--------|
|                                           |             |                                                                            | L                    | T | P | Total |        |
| Humanities, Social Science and Management | HM-BT501    | Bioethics and IPR in Biotechnology                                         | 2                    | 0 | 0 | 2     | 2      |
| Engineering Science                       | ES-BT501    | Transfer Operation-II                                                      | 3                    | 0 | 0 | 3     | 3      |
| Professional Core                         | PC-BT501    | Genetics and Genetic Engineering                                           | 3                    | 0 | 0 | 3     | 3      |
| Professional Core                         | PC-BT502    | Bioinformatics                                                             | 3                    | 0 | 0 | 3     | 3      |
| Professional Core                         | PC-BT503    | Bioreactor Design and Analysis                                             | 3                    | 0 | 0 | 3     | 3      |
| Open Elective                             | OE-BT501    | Data Base Management System and Computer Networking (OE-BT501A)            | 3                    | 0 | 0 | 3     | 3      |
|                                           |             | Nanotechnology (OE-BT501B)                                                 |                      |   |   |       |        |
|                                           |             | Marine Biotechnology (OE-BT501C)                                           |                      |   |   |       |        |
| Engineering Science                       | ES-BT591    | Transfer Operation-II Laboratory                                           | 0                    | 0 | 2 | 2     | 1      |
| Professional Core                         | PC-BT591    | Genetics and Genetic Engineering Laboratory                                | 0                    | 0 | 2 | 2     | 1      |
| Professional Core                         | PC-BT592    | Bioinformatics Laboratory                                                  | 0                    | 0 | 2 | 2     | 1      |
| Open Elective                             | OE-BT591    | Data Base Management System and Computer Networking Laboratory (OE-BT591A) | 0                    | 0 | 2 | 2     | 1      |
|                                           |             | Nanotechnology Laboratory (OE-BT591B)                                      |                      |   |   |       |        |
|                                           |             | Marine Biotechnology Laboratory (OE-BT591C)                                |                      |   |   |       |        |
| Total Credit                              |             |                                                                            |                      |   |   |       | 21     |

**B.TECH 3<sup>RD</sup> YEAR (SEMESTER VI)**

| Field             | Course Code | Course Name                                | Contact Hours / Week |   |   |       | Credit |
|-------------------|-------------|--------------------------------------------|----------------------|---|---|-------|--------|
|                   |             |                                            | L                    | T | P | Total |        |
| Professional Core | PC-BT601    | Recombinant DNA Technology                 | 3                    | 0 | 0 | 3     | 3      |
| Professional Core | PC-BT602    | Immunology                                 | 3                    | 0 | 0 | 3     | 3      |
| Professional Core | PC-BT603    | Plant Biotechnology                        | 3                    | 0 | 0 | 3     | 3      |
| Professional Core | PC-BT604    | Downstream Processing                      | 3                    | 1 | 0 | 4     | 4      |
| Professional Core | PC-BT605    | Animal Cell Culture & Animal Biotechnology | 3                    | 0 | 0 | 3     | 3      |
| Professional Core | PC-BT691    | Recombinant DNA Technology Laboratory      | 0                    | 0 | 2 | 2     | 1      |
| Professional Core | PC-BT692    | Immunology Laboratory                      | 0                    | 0 | 2 | 2     | 1      |
| Professional Core | PC-BT693    | Plant Biotechnology Laboratory             | 0                    | 0 | 2 | 2     | 1      |
| Professional Core | PC-BT694    | Downstream Processing Laboratory           | 0                    | 0 | 2 | 2     | 1      |
| Mandatory Course  | MC-BT681    | Sports and Yoga                            | 0                    | 0 | 2 | 2     | 0      |
| Total Credit      |             |                                            |                      |   |   |       | 20     |

**Total credit in 3<sup>rd</sup> year 41**

\* Students will undergo an Industrial Internship after 6<sup>th</sup> Semester Examination for a period of 2-4 weeks and that will be evaluated during 7<sup>th</sup> Semester Examination as the Paper code SI-BT781.

**B.TECH 4<sup>TH</sup> YEAR (SEMESTER VII)**

| Field                                     | Course Code | Course Name                                                            | Contact Hours / Week |   |   |       | Credit |
|-------------------------------------------|-------------|------------------------------------------------------------------------|----------------------|---|---|-------|--------|
|                                           |             |                                                                        | L                    | T | P | Total |        |
| Humanities, Social Science and Management | HM-BT701    | Entrepreneurship and Startup in Biotechnology                          | 2                    | 0 | 0 | 2     | 2      |
| Professional Core                         | PC-BT701    | Bioprocess Technology                                                  | 3                    | 0 | 0 | 3     | 3      |
| Professional Elective                     | PE-BT701    | Pharmaceutical Biotechnology (PE-BT701A)                               | 3                    | 0 | 0 | 3     | 3      |
|                                           |             | Introduction to Artificial Intelligence & Machine Learning (PE-BT701B) |                      |   |   |       |        |
|                                           |             | Medical Parasitology (PE-BT701C)                                       |                      |   |   |       |        |
|                                           |             | Advanced Food Engineering and Management (PE-BT701D)                   |                      |   |   |       |        |
| Professional Elective                     | PE-BT702    | Biomaterials (PE-BT702A)                                               | 3                    | 0 | 0 | 3     | 3      |
|                                           |             | Bioinspired Engineering (PE-BT702B)                                    |                      |   |   |       |        |
|                                           |             | Tissue Engineering (PE-BT702C)                                         |                      |   |   |       |        |
| Professional Elective                     | PE-BT703    | Cancer Biology and Therapeutics (PE-BT703A)                            | 3                    | 0 | 0 | 3     | 3      |
|                                           |             | Gene Expression and Transgenics (PE-BT703B)                            |                      |   |   |       |        |
|                                           |             | Protein Engineering (PE-BT703C)                                        |                      |   |   |       |        |
|                                           |             | Clinical Embryology (PE-BT703D)                                        |                      |   |   |       |        |
| Open Elective                             | OE-BT701    | Forensic Science (OE-BT701A)                                           | 3                    | 0 | 0 | 3     | 3      |
|                                           |             | Biomedical Instrumentation (OE-BT701B)                                 |                      |   |   |       |        |
|                                           |             | Healthcare Informatics (OE-BT701C)                                     |                      |   |   |       |        |
|                                           |             | Laboratory Informatics (OE-BT701D)                                     |                      |   |   |       |        |
| Professional Core                         | PC-BT791    | Bioprocess Technology Laboratory                                       | 0                    | 0 | 2 | 0     | 1      |
| Summer Internship                         | *SI-BT781   | Summer Internship-I [Seminar / Training / Workshop (Online / Offline)] | 0                    | 0 | 4 | 4     | 2      |
| Project                                   | PW-BT781    | Project Work-I (In House / Industry / Research Institute)              | 0                    | 0 | 2 | 2     | 1      |
| Total Credit                              |             |                                                                        |                      |   |   |       | 21     |

**B.TECH 4<sup>TH</sup> YEAR (SEMESTER VIII)**

| Field                                              | Course Code | Course Name                                                                                                         | Contact Hours / Week |   |    |       | Credit |
|----------------------------------------------------|-------------|---------------------------------------------------------------------------------------------------------------------|----------------------|---|----|-------|--------|
|                                                    |             |                                                                                                                     | L                    | T | P  | Total |        |
| Humanities,<br>Social Science<br>and<br>Management | HM-BT881    | Technical Communication<br>and Collaborative<br>Practices                                                           | 0                    | 0 | 2  | 2     | 1      |
| Humanities,<br>Social Science<br>and<br>Management | HM-BT882    | Technical and Popular<br>science article writing and<br>Seminar Presentation<br>(Based on Review article<br>by PPT) | 0                    | 0 | 4  | 4     | 2      |
| Summer<br>Internship                               | SI-BT881    | Summer Internship-II<br>[Seminar / Training /<br>Workshop (Online /<br>Offline)]                                    | 0                    | 0 | 16 | 16    | 8      |
| Project                                            | PW-BT881    | Project Work-II (In House<br>/ Industry / Research<br>Institute)                                                    | 0                    | 0 | 18 | 18    | 9      |
| Total Credit                                       |             |                                                                                                                     |                      |   |    |       | 20     |

Total credit in 4<sup>th</sup> year 41

Total credit in Four years 162

### DISTRIBUTION OF CREDITS

| Category                           | 1st Semester | 2nd Semester | 3rd Semester | 4th Semester | 5th Semester | 6th Semester | 7th Semester | 8th Semester | Total Credit |
|------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Basic Science (BS)                 | 9.5          | 9.5          | 5            | -            | -            | -            | -            | -            | 24           |
| Engineering Science (ES)           | 9            | 7            | -            | 4            | 4            | -            | -            | -            | 24           |
| Humanities and Social Science (HM) | -            | 5            | 3            | -            | 2            | -            | 2            | 3            | 15           |
| Professional Core (PC)             | -            | -            | 12           | 4            | 11           | 20           | 4            | -            | 51           |
| Professional Elective (PE)         | -            | -            | -            | 5            | -            | -            | 9            | -            | 14           |
| Open Elective (OE)                 | -            | -            | -            | 7            | 4            | -            | 3            | -            | 14           |
| Mandatory Course (MC)              | -            | -            | 0            | -            | -            | 0            | -            | -            | 0            |
| Universal Human Value (XC)         | 0            | -            | -            | -            | -            | -            | -            | -            | 0            |
| Summer Internship (SI)             | -            | -            | -            | -            | -            | -            | 2            | 8            | 10           |
| Project Work (PW)                  | -            | -            | -            | -            | -            | -            | 1            | 9            | 10           |
| Total Credit                       | 18.5         | 21.5         | 20           | 20           | 21           | 20           | 21           | 20           | 162          |