



**Darrang College
(Autonomous),
Tezpur-784001**

Syllabus for Certificate Course

Course Name: Biomass and Bioenergy

CERTIFICATE COURSE

ON

Biomass and Bioenergy

**DEPARTMENT OF BIOTECHNOLOGY
DARRANG COLLEGE (AUTONOMOUS), TEZPUR**

YEAR: 2025

Dr. Manika D Kataki
Course Coordinator
Head, Dept. of Biotechnology
Darrang College, Tezpur

Resource persons:

Faculty Members of the Department of Biotechnology

1. Dr. Manika D Kataki
Asst. Professor & Head, Dept. of Biotechnology
Darrang College (Autonomous), Tezpur
2. Ms. Minakshee Sarmah
Asst. Professor, Dept. of Biotechnology
Darrang College (Autonomous), Tezpur
3. Dr. Pranjal Pratim Das
Asst. Professor, Dept. of Biotechnology
Darrang College (Autonomous), Tezpur
4. Dr. Debashree Saikia
Asst. Professor, Dept. of Biotechnology
Darrang College (Autonomous), Tezpur

Experts from other Institutions:

Dr. Dhanapati Deka, Professor, (Bioenergy)
Department of Energy
Tezpur University
Napaam, Tezpur

Dr. Rupam Kataki, Professor, (Biofuel)
Department of Energy
Tezpur University
Napaam, Tezpur

Dr. Sadhan Mahapatra, Professor, (Biomass Gasification)
Department of Energy
Tezpur University
Napaam, Tezpur

CERTIFICATE COURSE ON “BIOMASS AND BIOENERGY”

OBJECTIVES

1. The main objective is to develop knowledge and skills on surrounding biomass, their conversion to economic and ecofriendly products and to generate awareness regarding its scope and applications in bioeconomy, employment, and entrepreneurship opportunities.
2. To make the participants aware on the development on global bioenergy sectors and future green energy demand.
3. To introduce the recent government policies on Bioenergy and Bioeconomy.

ELIGIBILITY

Minimum 10+2 Pass from any Stream of Science

NUMBER OF SEATS

TWENTY (30)

COURSE DURATION

Three months October, 2025- December, 2025

NUMBER OF CLASSES AND PRACTICALS

Classes: Total 40 Hours (Theory-30, Practical-10)

TOTAL COURSE FEES

Rs/- 200 (Registration fees)

Certificate will be awarded after successful completion of the course. Assessment will be carried out after completion of each module through Internal/Final Exam (MCQ)/Group Discussion/Quiz, etc.

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BRIEF ACCOUNT ON THE COURSE

The following topics were prioritized for development into Core Learning modules:

- **Biomass Overview:**

This introductory module is developed to provide context-setting information, in order to understand the importance and scope of biomass in the global energy needs and pollution. Theoretical knowledge and practical importance are presented to motivate the students for skill development in renewable energy, with an especial focus on biomass energy production technologies and applications.

- **Biomass Processing Techniques:**

This module introduces users to the different techniques of biomass processing aimed at safeguarding environment and energy production when working with biological material (Including waste) and/or biotechnology applications. A functional framework for biomass processing comprises: physical processing techniques like size, reduction, briquetting, drying, storage, and proper handling of biomass feedstock.

- **Biomass Conversion Technologies:**

The purpose of this module is to impart knowledge and skills to users for the conversion of biomass to energy or energy-rich products. At the end of the module, users can understand surrounding biomass and bioenergy using combustion, anaerobic digestion, pyrolysis, gasification, and fermentation. The users will also learn the numerous benefits from this module, such as greenhouse gas reduction, energy security, waste management, and economic benefits including diverse applications, challenges, and limitations in biofuels, biochemicals, and bioenergy.

- **Waste Management and Bioenergy:**

Waste management and bioenergy are closely linked, as waste can be a valuable resource for producing bioenergy. The importance of waste management and bioenergy includes: sustainable renewable energy source, waste reduction, greenhouse gas reduction, future energy security, and economic benefits. In this module, the users will learn the potential of our rich biodiversity and applications of biotechnology for the production of bioethanol, biobutanol, and biodiesel.

- **Biogas Production and Digesters:**

The purpose of this module is to impart knowledge and skills for sustainable development through waste management, renewable energy and climate change mitigation. Learning this module will help the user to understand the numerous benefits for the environment, economy, and society. Hands-on biogas production in biogas plant will motivate the user to understand its microbial and biochemical aspects, operating parameters, role of digesters, and kinetics of biogas production.

- **Bioeconomy and Bioenergy policies:**

Bioeconomy and bioenergy policies are crucial for promoting sustainable development, reducing greenhouse gas emission, and enhancing energy security. These policies vary globally, but most of them aim to promote renewable energy and to support sustainable development. This module offers the information on regulatory framework, incentives, financing, education and training of bioeconomy and bioenergy policies of India. The users will also learn the BioE3 policy or Biotechnology for Economy, Environment, and Employment policy of India aiming to drive economic growth, environmental sustainability, and job-creation through the development of bio-based products and services.

Design Elements to Enhance the Learning Experience

Several features were customized for this learning platform to provide a sophisticated and robust interactive learning experience. These focused on:

➤ Use of multimedia:

Using a variety of media (multimedia) in a learning experience stimulates and encourages users to think more reflectively and helps in maintaining their interest in the learning material. As with many complex scientific topics, the concepts of bioenergy are therefore best conveyed to users by exploiting the array of multimedia tools available, and as such, elements were therefore selected within the eLearning platform to accommodate a wide range of media formats. This learning platform is designed to incorporate static and animated graphic elements, video lectures, interactive diagrams, external reading material and other resources. The module developer is then equipped to incorporate these various elements, as needed, to best present the material to the users. For example, a video lecture describing the key features of a energy production set-up can be complemented with an interactive diagram of such a lab, in order to reinforce the key points from the presentation and help the users to understand that the features of a typical energy production plant are specifically designed to work together as a system in order to ensure containment.

➤ Compatibility with mobile technology:

Besides offline interactive classes, the specific eLearning platform is selected in the acknowledgement that the primary access by users may very well be through the use of mobile technology, e.g., tablets or even smartphones. The platform itself, as well as the presentation of the content, had to support access by a variety of devices, so that each user would always have a high-quality experience, regardless of the device used.

➤ Interactive glossary:

Bioenergy production is fraught with technical terminology, including words such as “pyrolysis, briquetting, digesters” which have a plain-English definition that is subtly different from its more technological definition. The Learning platform was therefore designed to incorporate a readily-accessible drop-down glossary into each module, which prompts the user when a new vocabulary item is encountered for the first time, and then would serve as a compendium of all vocabulary items associated across the portfolio, to which the user can refer at any time.

➤ **Exercises and intermediate tests:**

Bioenergy concepts are challenging to teach, learn, and to practice primarily because many of the high-level concepts are grounded in one or more fundamental concepts. Any misunderstanding of these basic concepts, such as the meaning of fermentation, growth medium, etc may make it impossible for a user to then understand related concepts. The e-Learning platform was therefore designed to enable the portfolio administrator to assess the degree of user understanding throughout the module, with the aid of short exercises and intermediate tests, as this helps to verify that the user understands all the fundamental concepts before then advancing further into the module with presentations of more complex concepts. Exercises and quizzes can also provide helpful feedback to the user, and even direct the user to review particular sections of the module in order to clarify and resolve any misunderstanding before delving further into the teaching.

➤ **Final exam:**

To effectively verify that each user has mastered the key concepts of the module, the eLearning platform enables the content developer and/or host institution to include a final exam, which the user must complete and pass. Currently, the final exam (and any intermediate tests) of each module will comprise of several types of questions randomly extracted from a much larger database of questions, which will include: true/false, multiple-choice with only one correct answer, multiple-choice with more than one correct answer, ranking questions, and questions using an interactive diagram; and more question formats are under development.

The platform can offer learning environments with differing pass rates (of the modules themselves, as well as for the portfolio overall), as well as differing options for re-sitting examinations, tailored to each hosting institution's requirements. To elaborate, each individual hosting institution can dictate: the number of questions from the database to be included in each test and exam, the pass rate for each, the pre-determined waiting period before any exam re-sit, and also the number of times the exams can be re-sat.

This will include exercises, quiz, tests, and exam questions to check learning, provide feedback, and increase user engagement.

DISCUSSION AND CONCLUSION ON THE COURSE

From the perspective of this Certificate Course, the endorsement of learning experience of user would include:

- Learning objectives should be clearly elaborated at the outset to ensure that each module covers all of the intended subject material, and that it interconnects within the overall curriculum.
- Experts should be briefed on the possibilities and limitations of the Learning platform, in order to prepare content that provides the best learning experience.
- Experts must be made aware of the diversity of materials that can be used and should select the best suited format, e.g., background documents for longer texts.
- Consistency is essential and tools, such as a common glossary, should be compiled for all modules and shared by all experts.

The current portfolio of Biomass and Bioenergy modules offers a great promise in the development of autonomous and enduring systems that are relevant, useful, and resilient. The most obvious benefits from utilizing e-Learning in **Biomass and Bioenergy** training include:

- **Flexible approach:** To provide hosting institutions as well as users with the flexibility of time and place of delivery.
- **Comprehensive coverage:** To enhance the efficacy of knowledge and qualifications via an ease of access to a huge amount of information.
- **Cost-effectiveness:** Soft copy and manuals will be provided. Also offers learning opportunities to a maximum number of users, without the need for education premises and facilities, through Google classroom.
- **User-friendly:** Takes into consideration user's individual learning styles and paces.
- **Sustainable:** Helps to compensate for any local scarcities of experts, allowing hosting institutions to take charge of local training needs, at minimal expense, and staff time investment.

In this way, the portfolio of modules is supportive of the harmonization of similar regulatory approaches, when applicable, as well as being of broader utility to post-graduates seeking employment across government and private regulatory agencies. The curriculum will be continuously revised as new issues and information emerge so that it stays relevant to emerging biosafety and biohazard concerns and approaches.

CURRICULUM

- 1. Biomass Overview:** Sources, Classification, Chemical Composition, Properties of Biomass and its importance.
Prof. Dhanapati Deka, Dept. of Energy, Tezpur University
Dr. Manika Das Kataki, Faculty, Dept. of Biotechnology
- 2. Biomass Processing Techniques:** Physical processes-Size reduction, Briquetting, Drying, Storage, and Handling of Biomass feedstock.
Mrs. Minakshee Sarmah, Faculty, Dept. of Biotechnology
- 3. Biomass Conversion Technologies:** Combustion, Anaerobic Digestion, Pyrolysis, Gasification, Fermentation, and their applications.
Dr. Manika D Kataki, Faculty, Dept. of Biotechnology
- 4. Waste Management and Bioenergy:** Introduction, Waste classification, Renewable Energy-Introduction, Types-Bioethanol, Biobutanol, Biodiesel. Process and Advantages.
Prof. Rupam Kataki, Dept. of Energy, Tezpur University
Dr. Pranjal Pratim Das, Faculty, Dept. of Biotechnology
- 5. Biogas Production and Digesters:** Microbial and Biochemical aspects, Operating parameters, and Kinetics of Biogas Production, Introduction to Biogas Plant.
Prof. Sadhan Mahapatra, Dept. of Energy, Tezpur University
Dr. Pranjal Pratim Das, Faculty, Dept. of Biotechnology
- 6. Bioeconomy and Bioenergy Policies:** Importance and Benefits, Growth and Economic Contribution, Key drivers and Sectors, Government policies and initiatives-BioE3.
Dr. Debashree Saikia, Faculty, Dept. of Biotechnology

Practical:

1. Survey and collection on different biomass in selected area.
2. Selection and Processing of Biomass for Biogas Production
3. Understanding components and functions of Anaerobic Digesters
4. Production of Biogas in model Biogas Plant.

Signature

Dr. Manika D Kataki

Faculty, Dept. of Biotechnology

(Course Coordinator)

Department of Biotechnology, Darrang College (Autonomous), Tezpur

To,

Dated: 15/10/25

The Principal
Darrang College (Autonomous), Tezpur, Assam

Subject: Proposal for starting Certificate Course on 'Biomass and Bioenergy' from 20th Oct. –20th December 2025.

Sir,

This is with reference to the above mentioned, I would like to request you to permit us to start our first batch of Certificate Course on 'Biomass and Bioenergy', from 20th Oct.–20th December 2025.

We intend to develop skill, knowledge, and scope in practicing the conversion of biomass to bioenergy, so that they learn the importance of Biotechnology for Economy, Environment, and Employment policy of India

Please find attached herewith the proposal for your kind perusal and consideration.

Thanking you,

Sincerely,

Dr. Manika D Katak, Head
Course Coordinator
Department of Biotechnology
Darrang College, Tezpur

Copy to:-

IQAC Coordinator, Darrang College, Tezpur