

CURRICULUM STRUCTURE
FOR
BACHELOR OF TECHNOLOGY
IN
AGRICULTURAL ENGINEERING

(Applicable from the academic session 2023-2024)



Haldia Institute of Technology

**(An Autonomous Institution Under Maulana Abul Kalam Azad
University Of Technology, West Bengal)**

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Department of Agricultural Engineering

VISION

To create a platform for quality teaching-learning process where, the students are not only taught various subjects as per framed syllabus, but also exposed to the topic beyond it with an emphasis on blending of knowledge and skill and relevance of a topic or subject with the real-life situation so that one can adapt to the industrial requirements.

MISSION

M1

Contemporary Skills (M1): To create qualified and proficient technocrats having contemporary skills through outcome-based and self-learning strategies.

M2

Higher Studies And Research (M2): To encourage innovation-oriented and problem-based research capabilities in the young engineers through higher studies to nurture the progress of the society.

M3

Ethical And Human Values (M3): To instill strong ethical values and good professional behavior, so as to adapt and absorb emerging changes in the field of engineering profession.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Department of Agricultural Engineering

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO 1: To educate and groom the students with strong understanding and knowledge of mathematics, basic science and engineering coupled with contemporary skills in the areas of Agricultural Engineering

PEO 2: To equip the students for successful professional careers in Agricultural Engineering domain of private and government enterprises, to prepare for PG studies in engineering, management and allied areas, and to prepare for entrepreneurship.

PEO 3: To make the students aware of the societal aspects of engineering profession, ethical practices in profession, and the importance of team work to function coherently and effectively in multi-disciplinary context.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Department of Agricultural Engineering PROGRAM OUTCOMES (POs):

- PO1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Department of Agricultural Engineering

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO 1: Should be able to clearly understand, analyze and comprehend the different courses of Agricultural Engineering and other interdisciplinary courses and develop a holistic approach for implementation.

PSO 2: Should be able to apply the knowledge, techniques and skills acquired to provide solutions to the real world problems related to Agricultural Engineering.

PSO 3: Should have the capability to comprehend the advancements in the usage of modern design tools and latest techniques to analyze and design subsystems/processes for a variety of applications.

Haldia Institute of Technology
(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)
Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)

A. Definition of Credit

1Hr. Lecture (L) per week	1 credit
1Hr. Tutorial (T) per week	1 credit
1Hr. Practical (P) per week	0.5 credits

B. Range of credits

All B.Tech. programs include arrange of credits from 160 to 165.

C. Mandatory Additional Requirement (MAR) for earning B.Tech Degree

Every student, who is admitted to the 4 years B. Tech program from the academic year 2019-20 onwards, is required to earn *minimum 100* Activity Points, in addition to the required academic grades for getting B. Tech degree.

The MAR activities, (as per guideline of AICTE / affiliating University, MAKAUT) will provide necessary needs of modern industry and the society. Through this program, irrespective of one's technological field, each student develops the skill of active participation in the co-curricular and extra-curricular activities through SAWYAM based learning activities. Such activities enhance student's employability and global acceptances. Details are given in *Annexure-I*.

D. MOOCs for B.Tech Honours

A student will be eligible to get B.Tech Degree *with Honours*, if he/she completes an *additional 20 credits*, through Massive Open Online Courses (MOOCs). The complete description of the MOOCs relevant for the first year course is given in *Annexure-II*.

E. Guidelines regarding Mandatory Induction Program for the new students

The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighborhood, society and people. This will allow them to evolve as well rounded individuals. Details are given in *Annexure-III*.

F. Group division

Group-A

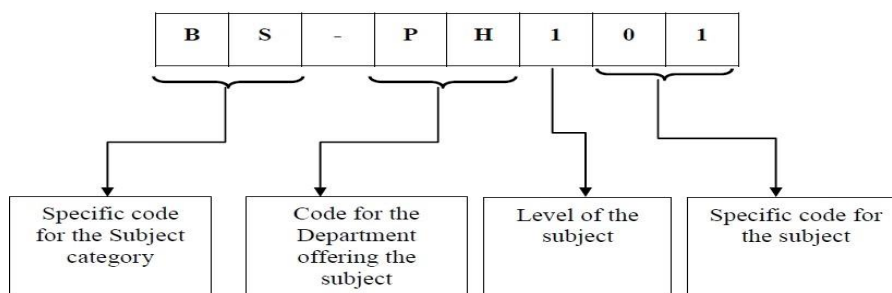
All non-IT based programme like –Mechanical Engineering (ME), Chemical Engineering (CHE), Civil Engineering (CE), Electrical Engineering (EE), Applied Electronics & Instrumentation Engineering (AEIE), Biotechnology (BT), Food Technology (FT), Agriculture Engineering (AE), and Electronics & Communication Engineering (ECE).

Group-B

All IT-based programmes like – Computer Science & Engineering (CSE), Computer Science & Engineering (Cyber Security), Computer Science & Engineering (Data Science), Computer Science & Engineering (Artificial Intelligence & Machine Learning), Information Technology.

Haldia Institute of Technology
 (An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)
Syllabus for B. Tech in Agricultural Engineering
 (Applicable from the academic session 2023-2024)

Subject Numbering Scheme:



List of Codes for Subject Category	
Code	Category Name
BS	Basic Science Courses
ES	Engineering Science Courses
HM	Humanities and Social Sciences including Management courses
PC	Professional core courses
PE	Professional Elective courses
OE	Open Elective courses
MC	Mandatory courses
PW	Project

Haldia Institute of Technology
(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)
Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)

Curriculum Structure

SEMESTER-I

<i>Theory</i>							
SI No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Mathematics-I[Group-A&B]	BS-M 101	100	3	1	0	4
2	Physics-I[Group-A] /Chemistry-I[Group-B]	BS-PH101/ BS-CH101	100	3	1	0	4
3	Basic Elec. & Electro. Engg. [Group-A] / Programming for problem solving [Group-B]	ES-EE101/ ES-CS101	100	3	1	0	4
4	English Language and Technical Communication. [Group-B]	HM-HU101	100	2	0	0	2
Total Marks:300 Total Credit: 12.0[Group-A]							
Total Marks:400 Total Credit: 14.0[Group-B]							
<i>Practical</i>							
5	Physics-I Lab [Group-A]/ Chemistry-I Lab[Group-B]	BS-PH191/ BS-CH191	100	0	0	3	1.5
6	Basic Elec. & Electro. Engg. Lab[Group-A]/ Programming Lab [Group-B]	ES-EE191/ ES-CS191	100	0	0	3	1.5
7	Workshop Practice [Group-A]/ Engg. Drawing [Group-B]	ES-ME191/ ES-ME 192	100	1	0	3	2.5
8	Language Lab[Group-B]	HM-HU191	100	0	0	2	1
<i>Extra Curricular Activity</i>							
9	NSS[Group-A]						
Total Marks: 300 & Total Credit: 5.5[Group-A]							
Total Marks:400 & Total Credit: 6.5[Group-B]							

Haldia Institute of Technology
 (An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)
Syllabus for B. Tech in Agricultural Engineering
 (Applicable from the academic session 2023-2024)

SEMESTER-II

<i>Theory</i>							
Sl No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Mathematics-II[Group-A&B]	BS-M 201	100	3	1	0	4
2	Chemistry-I[Group-A]/ Physics-I [Group-B]	BS-CH201/ BS-PH 201	100	3	1	0	4
3	Programming for problem solving [Group-A]/ Basic Elec. & Electro. Engg. [Group-B]	ES-CS201/ ES-EE201	100	3	1	0	4
4	English Language and Technical Communication [Group-A]	HM-HU201	100	2	0	0	2
Total Marks:400 Total Credit: 14.0[Group-A]							
Total Marks:300 Total Credit: 12.0[Group-B]							
<i>Practical</i>							
5	Chemistry-II Lab[Group-A]/ Physics-I Lab [Group-B]	BS-CH291/ BS-PH 291	100	0	0	3	1.5
6	Programming Lab[Group-A]/ Basic Elec. & Electro. Engg. Lab [Group-B]	ES-CS291/ ES-EE291	100	0	0	3	1.5
7	Workshop Practice [Group-B]/ Engg. Drawing [Group-A]	ES-ME291 /ES-ME292	100	1	0	3	2.5
8	Language Lab[Group-A]	HM-HU291	100	0	0	2	1
<i>Extra Curricular Activity</i>							
9	NSS[Group-B]						
Total Marks:400 & Total Credit: 6.5[Group-A]							
Total Marks:300 & Total Credit: 5.5[Group-B]							

Haldia Institute of Technology
 (An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)
Syllabus for B. Tech in Agricultural Engineering
 (Applicable from the academic session 2023-2024)

SEMESTER-III

Theory							
Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Engineering Thermodynamics & Heat Engines	ES-AE 301	100	3	0	0	3
2	Surveying and Levelling	ES-AE 302	100	3	0	0	3
3	Fluid Mechanics and Open Channel Hydraulics	PC-AE 301	100	3	0	0	3
4	Agriculture for Engineers	PC-AE 302	100	3	0	0	3
5	Professional Ethics & IPR	HM-AE 301	100	3	0	0	3
Total Marks: 500				Total Credit: 15			
Practical/Sessional/Tutorial							
1	Surveying and Levelling Lab	ES-AE 391	100	0	0	3	1.5
2	Fluid Mechanics Lab	PC-AE 391	100	0	0	3	1.5
3	Report Writing	SI-AE 381	100	0	2	0	2
4	NSS		100	0	0	3	0
Total Marks: 300				Total Credit: 5			
Total Credit							20(15+5)

Haldia Institute of Technology
(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)
Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)

SEMESTER-IV

Theory							
Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Refrigeration & Air Conditioning	ES-AE 401	100	3	0	0	3
2	Soil Mechanics	PC-AE 401	100	3	0	0	3
3	Theory of Machine and Machine Design	PC-AE 402	100	3	0	0	3
4	Watershed Hydrology	PC-AE 403	100	3	0	0	3
5	Numerical Methods & Statistical Methods	BS-AE 401	100	3	0	0	3
6	Environmental Science	MC-AE 401	100	2	0	0	2
7	Modelling and Simulation in agriculture	VAC-AE401	100	3	0	0	0
Total Marks: 600				Total Credit: 17			
Practical							
1	Soil Mechanics Lab	PC-AE 491	100	0	0	3	1.5
2	Watershed Hydrology Lab	PC-AE 492	100	0	0	3	1.5
3	Numerical Methods & Statistical Methods Lab	BS-AE 491	100	0	0	2	1
Total Marks: 300				Total Credit: 4			
Total							21(17+4)

NOTE: Value added course to be conducted at fourth semester.

Haldia Institute of Technology
(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)
Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)

SEMESTER-V

Theory							
Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Farm Machinery & Equipment	PC-AE 501	100	3	0	0	3
2	Irrigation & Drainage Engineering	PC-AE 502	100	3	0	0	3
3	Post Harvest Engineering	PC-AE 503	100	3	0	0	3
4	Heat and Mass Transfer	PC-AE 504	100	3	0	0	3
5	Professional Elective – I (Crop Production/Plastic applications in Agriculture/Seed Technology and Processing)	PE-AE 501 (A/B/C)	100	3	0	0	3
6	Open Elective–I (Fundamentals of Renewable Energy Sources/Bio- energy Systems: Design and Applications/ Building Construction and Cost Estimation)	OE-AE 501 (A/B/C)	100	3	0	0	3
7	Agriculture Economics	HM-AE 501	100	3	0	0	3
Total Marks: 700				Total Credit: 21			
Practical & Sessional							
1	Farm Machinery Lab	PC-AE 591	100	0	0	3	1.5
2	Irrigation & Drainage Engineering Lab	PC-AE 592	100	0	0	3	1.5
3	Post Harvest Engineering Lab	PC-AE 593	100	0	0	2	1
4	NSS		100	0	0	3	0
Total Marks: 300				Total Credit: 4			
Total Credit							25(21+4)

Haldia Institute of Technology
 (An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)
Syllabus for B. Tech in Agricultural Engineering
 (Applicable from the academic session 2023-2024)

SEMESTER-VI

Theory							
Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Soil and Water Conservation Engineering	PC-AE 601	100	3	0	0	3
2	Entrepreneurship Development & Business Management	HM-AE 601	100	3	0	0	3
3	Professional Elective – II (Groundwater, Wells and Pumps/ Watershed Planning & Management/ Pressurized Irrigation System)	PE-AE 601 (A/B/C)	100	3	0	0	3
4	Professional Elective – III (Tractor and Farm Machinery Operation and Maintenance/ Tractor Systems and Controls/ Pump Engineering & Hydraulic Control)	PE-AE 602 (A/B/C)	100	3	0	0	3
5	Open Elective– II (Database Management System/ Data Structure & Algorithm/ Web Designing and Internet Applications)	OE-AE 601 (A/B/C)	100	3	0	0	3
6	Ethics in Engineering Practice/	MC-AE 601	100	2	0	0	2

Haldia Institute of Technology
 (An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)
Syllabus for B. Tech in Agricultural Engineering
 (Applicable from the academic session 2023-2024)

	Essence of Indian Knowledge Tradition						
Total Marks: 600 Total Credit: 17							
Practical							
1	Soil and Water Conservation Engineering Lab	PC-AE 691	100	0	0	3	1.5
2	Open Elective– II Lab (Database Management System Lab)	OE-AE 691	100	0	0	3	1.5
3	Industrial Internship–I	SI-AE 681	100	0	2	0	2
Total Marks: 300 Total Credit: 5							
Total Credit						22(17+5)	

NOTE: Internship I to be conducted after fifth semester and to be evaluated in sixth semester.

Haldia Institute of Technology
(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)
Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)

SEMESTER-VII

Theory							
Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Dairy and Food Engineering	PC-AE 701	100	3	0	0	3
2	Professional Elective– IV (Waste and By-Product Utilization/Food Packaging Technology/Food quality management)	PE-AE 701 (A/B/C)	100	3	0	0	3
3	Professional Elective– V (Wasteland Development/ Minor Irrigation and Command Area Development / Floods and Control Measures)	PE-AE 702 (A/B/C)	100	3	0	0	3
4	Open Elective –III (Smart Agriculture/Management of Canal Irrigation System/ Precision Farming Techniques for Protected Cultivation)	OE-AE 701 (A/B/C)	100	3	0	0	3
5	Open Elective – IV (Remote Sensing and GIS Application/ Mechanics of Tillage and Traction/ Development of Processed Product)	OE-AE 702 (A/B/C)	100	3	0	0	3
Total Marks: 500			Total Credit: 15				
Practical							
1	Dairy and Food Engineering Lab	PC-AE 791	100	0	0	2	1
2	Industrial Internship–II	SI-AE 781	100	0	3	0	2
3	Project Work and Presentation–I	PW-AE 781	100	-	-	-	4
4	NSS		100	0	0	3	0
Total Marks: 300			Total Credit: 7				
Total Credit						22(15+7)	

NOTE: Internship II to be conducted after sixth semester and to be evaluated in seventh semester.

Haldia Institute of Technology
(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)
Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)

SEMESTER-VIII

Theory							
Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Agricultural Extension Activities	PC-AE 801	100	3	0	0	3
2	Open Elective – V (System Engineering/Wind Power Technology and System/Photovoltaic Technology and System)	OE-AE 801 (A/B/C)	100	3	0	0	3
3	Nano-science and Technology in Agriculture	VAC-AE801	100	3	0	0	0
Total Marks: 200				Total Credit: 6			
Practical & Sessional							
1	Project Work and Presentation/Viva voce–II	PW-AE 881	100	-	-	-	4
2	Industrial Internship –III	SI-AE 881	100	0	0	6	3
Total Marks: 200				Total Credit: 7			
Total Credit							13(6+7)

NOTE: Internship III to be conducted after seventh semester and to be evaluated in eighth semester.

COURSE CURRICULA
B.TECH, 1STYR - 1STSEMESTER

<i>Theory</i>							
Sl No	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Mathematics-I [Group-A&B]	BS-M101	100	3	1	0	4
2	Physics-I [Group-A] /Chemistry-I [Group-B]	BS-PH101/ BS-CH101	100	3	1	0	4
3	Basic Elec. & Electro. Engg.[Group-A]/ Programming for problem solving [Group-B]	ES-EE101/ ES-CS101	100	3	1	0	4
4	English Language and Technical Communication. [Group-B]	HM-HU101	100	2	0	0	2
Total Marks:300				Total Credit: 12.0[Group-A]			
Total Marks:400				Total Credit: 14.0[Group-B]			
<i>Practical</i>							
5	Physics-I Lab [Group-A]/ Chemistry-I Lab[Group-B]	BS-PH191/ BS-CH191	100	0	0	3	1.5
6	Basic Elec. & Electro. Engg. Lab [Group-A] / Programming Lab [Group-B]	ES-EE 191/ ES-CS191	100	0	0	3	1.5
7	Workshop Practice [Group-A]/ Engg. Drawing [Group-B]	ES-ME191/ ES-ME 192	100	1	0	3	2.5
8	Language Lab[Group-B]	HM-HU191	100	0	0	2	1
<i>Extra Curricular Activity</i>							
9	NSS[Group-A]						
Total Marks: 300&Total Credit:				5.5[Group-A]			
Total Marks:400&Total Credit:				6.5[Group-B]			

COURSE CURRICULA
B.TECH, 1ST YR - 2ND SEMESTER

<i>Theory</i>							
Sl No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Mathematics-II [Group-A&B]	BS-M201	100	3	1	0	4
2	Chemistry-I [Group-A]/ Physics-I [Group-B]	BS-CH201/ BS-PH 201	100	3	1	0	4
3	Programming for problem solving [Group-A]/ Basic Elec. & Electro. Engg. [Group-B]	ES-CS201 / ES-EE 201	100	3	1	0	4
4	English Language and Technical Communication [Group-A]	HM-HU201	100	2	0	0	2
Total Marks: 400 Total Credit: 14.0 [Group-A] Total Marks: 300 Total Credit: 12.0 [Group-B]							
<i>Practical</i>							
5	Chemistry-I Lab [Group-A]/ Physics-I Lab [Group-B]	BS-CH291/ BS-PH 291	100	0	0	3	1.5
6	Programming Lab [Group-A]/ Basic Elec. & Electro. Engg. Lab [Group-B]	ES-CS291/ ES-EE 291	100	0	0	3	1.5
7	Workshop Practice [Group-B] Engg. Drawing [Group-A] /	ES-ME291 /ES-ME292	100	1	0	3	2.5
8	Language Lab [Group-A]	HM-HU291	100	0	0	2	1
<i>Extra Curricular Activity</i>							
9	NSS [Group-B]						
Total Marks: 400 & Total Credit: 6.5 [Group-A] Total Marks: 300 & Total Credit: 5.5 [Group-B]							

Paper Name: Mathematics-I	Category: Basic Science Course
Paper Code: BS-M101	Semester: First
L-T-P: 3-1-0	Credit: 4

Total Lecture: 45L

Course Objectives

- Providing the core concepts of higher Engineering Mathematics and describing the techniques, this works as an essential tool to solve the problems in their field of applications.
- To provide an overview of Differential Equations, Laplace Transform and Complex Analysis to engineers.

Module-1[8L] Matrix &

Determinant:

Inverse and rank of a matrix; Elementary row and column operation so vera matrix; System of linear equations and its consistency; Rank and nullity; Determinants; minors and cofactors; Eigen values and eigen vectors; Diagonalization of matrices; Cayley Hamilton theorem; Orthogonal transformation.

Module-2[9L]

Differential Calculus:

Successive derivative, Leibnitz's Theorem; Rolle's Theorem, Mean value theorem, Taylor's and Maclaurin's theorems with remainders;

Sequence and Series:

Basic concept of Convergence of sequence and series; Tests for convergence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test (statements and related problems on these tests), Raabe's test; Alternating series; Leibnitz's Test (statement only); Absolute convergence and Conditional convergence.

Module-3[8L]

Integral calculus:

Improper integrals; Beta and Gamma functions and their properties; Convergence of improper integrals; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Differentiation under integral sign.

Module-4[10L]

Calculus of function of several variables:

Introduction to functions of several variables; Limit and continuity, Partial derivatives, Homogeneous functions and Euler's theorem up to three variables, Chain rules, Differentiation of implicit functions, Total differentials and their applications, Jacobians up to three variables Maxima, minima; Saddle points of functions; Lagrange Multiplier method and their applications; Concept of line integrals, Double and triple integrals.

Module-5[10L]

Vector Calculus:

Scalar and vector triple products with related problems, Equation of straight line, plane and sphere. Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative. Related problems on these topics. Green's theorem, Gauss Divergence Theorem and Stoke's theorem (Applications only, proofs not required).

Course Outcomes(COs)

- CO1. To provide students with skills in algebra and calculus which would enable them to devise engineering solutions for given situations they may encounter in their profession.
- CO2. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice by enhancing the power of knowledge and imagination
- CO3. Prepare students for realization of journal papers outcomes, and expose them to the world of research. Illustrate the current research works and publications of the subjects in different fields adopted by the students as per course curriculum in various journals and literature.
- CO4. To explore and enhance research potential explain how the ideas those are adopted can be implemented through projects and demonstrate various models, recent project proposals executing the knowledge adopted from the course.
- CO5. An ability to function on multi-disciplinary teams. Lighten on the latest and modern developments in the fields.
- CO6. Explain about ethical awareness and impact in the field of environmental, social and safety of the finished products. Describe the pollution, legal aspects and impacts may arise in large scale production.

Learning Resources

1. Advanced Engineering Mathematics, by Erwin Kreyszig is published by Wiley India
2. Engineering Mathematics: B.S.Grewal(S.Chand & Co.)
3. Higher Engineering Mathematics: John Bird (4th Edition, 1st Indian Reprint 2006, Elsevier)
4. Engineering Mathematics: S.S.Sastry(PHI, 4th Edition, 2008)
5. Advanced Engineering Mathematics, 3E: M.C.Potter, J.L.Goldberg and E.F.Abonfadel (OUP), Indian Edition.

Paper Name: Mathematics-II	Category: Basic Science Course
Paper Code: BS-M201	Semester: Second
L-T-P: 3-1-0	Credit: 4

Total Lecture: 45L

Course Objectives

- Providing the core concepts of higher Engineering Mathematics and describing the Techniques, this works as an essential tool to solve the problems in their field of applications.
- To provide an overview of Differential Equations, Laplace Transform and Complex Analysis to engineers.

Module-1 [10L]

Ordinary differential equation (ODE)-First order and first degree: Exact equations, Necessary and sufficient condition for exactness of a first order and first degree ODE (statement only), Rules for finding Integrating factors, Linear and non-linear differential equation, Bernoulli's equation. General solution of ODE of first order and higher degree (different forms with special reference to Clairaut's equation).

Second order and first degree: General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods for finding P.I., Method of variation of parameters, Cauchy-Euler equations.

Module-2 [5L]

Basics of Graph Theory: Graphs, Digraphs, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Subgraph,; Walks, Paths, Circuits, Euler Graph, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph.

Module-3 [10L]

Laplace Transform: Introduction to integral transformation, functions of exponential order, Definition and existence of LT (initial and final value theorem with applications proofs not required), LT of elementary functions, Properties of Laplace Transformations, Evaluation of sine, cosine and exponential integrals using LT, LT of periodic and step functions.

Definition and properties of inverse LT Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODEs with constant coefficients (initial value problem) using LT.

Module-4 [12L]

Complex Variable: Complex functions, Concept of Limit, Continuity and Differentiability. Analytic functions, Cauchy-Riemann Equations (statement only). Sufficient condition for a function to be analytic. Harmonic function and Conjugate Harmonic function, related problems. Construction of Analytic functions: Milne Thomson method, related problems. Conformal mappings, Bilinear transformation, Mobius transformations and their properties.

Complex Integration: Concept of simple curve, closed curve, smooth curve & contour. Some elementary properties of complex Integrals. Line integrals along a piecewise smooth curve. Cauchy's theorem (statement only). Cauchy-Goursat theorem (statement only). Cauchy's integral formula, Cauchy's integral formula for the derivative of an analytic function, Cauchy's integral formula for the successive derivatives of an analytic function.

Module-5[8L]**Zeros and Singularities of an Analytic Function & Residue Theorem.**

Zero of an Analytic function, order of zero, Singularities of an analytic function. Isolated and non-isolated singularity, essential singularities. Poles: simple pole, pole of order m . Examples on determination of singularities and their nature. Taylor's series, Laurent's series.

Residue, Cauchy's Residue theorem (statement only), problems on finding the residue of a given function, evaluation of definite integrals: $\int_0^{\infty} \frac{\sin x}{x} dx$, $\int_0^{2\pi} \frac{d\theta}{a+b\cos\theta+c\sin\theta}$, $\oint_C \frac{P(z)}{Q(z)} dz$ (elementary cases, $P(z)$ & $Q(z)$ are polynomials of 2nd order or less). Evaluation of ∞ improper integrals using the Bromwich contour.

Course Outcomes (COs)

- CO1. Recall the earlier mathematical thoughts, such as idea of derivative, integration, ordinary differential equations and complex algebra.
- CO2. Exhibit the idea of ordinary differential equation of first and higher order. Recognize the concept of graph theory and Laplace transform and complex variable.
- CO3. Apply the knowledge of Laplace transform to reduce the complexity of differential equation. Use different graphical algorithm to find optimal solutions.
- CO4. Analyze the ideas of mentioned mathematical tools so that it can be implemented to real time engineering problems
- CO5. Justify and make gradation of above mentioned mathematical tools and determine the right approach to solve multidisciplinary engineering problems.
- CO6. Build up logical and analytical skills to create a new wide appreciated by academics, research & emerging trends in industry.

Learning Resources

1. Probability and Statistics for Engineers, Miller & Freund R. A. Johnson, Prentice Hall of India
2. Advanced Engineering Mathematics, Erwin Kreyszig, (Wiley Eastern)
3. Graph Theory: V.K. Balakrishnan, (Schaum's Outline, TMH)
4. Engineering Mathematics: B.S. Grewal (S. Chand & Co.)
5. Introductory Course in Differential Equations: Daniel A. Murray (Longmans & Green).
6. Graph Theory: N. Deo (Prentice-Hall of India)
7. Numerical Analysis and Computational Procedures, Sahajahan Ali Mollah, Books & Allied Ltd
8. Fundamentals of Mathematical Statistics, Gupta & Kapoor, (Sultan Chand & Sons).
9. Schaum's Outlines: Laplace Transforms, Murray R. Spiegel,

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Paper Name: Physics-I	Category: Basic Science Course
Paper Code: BS-PH101/BS-PH201	Semester: First/ Second
L-T-P: 3-1-0	Credit: 4

Total Lecture: 42L

Course Objectives

- To introduce the rudimentary and relevant concepts of physics to different branches of Engineering and Technology.
- To compile all the knowledge acquired from the course and to apply in industry, academia, and research keeping in the mind about ethical awareness and impact in the field of environmental (pollution), social (legal) and safety.

Module-1 [10L]

Vector Calculus

Gradient of a Scalar function, Divergence and Curl of Vector field, Vector Integration—Line-, surface and volume integration - Divergence and Stoke's Theorem

Oscillations And Waves

Simple Harmonic Oscillation- Motion of simple and compound pendulum –Energy Considerations - Coupled oscillations, approximate solutions, linear and transverse oscillations. Damped Oscillations – Over damped - critical damping –oscillatory damping – Relaxation time & log decrement. Forced oscillation – Electromechanical Analogy between Mechanical Oscillator with Electrical circuit – Mechanical Impedance - Transient and Steady state oscillations – Resonance - Power considerations - Low and high frequency responses – Bandwidth – Quality factor - Sharpness of Resonance

Module-2 [11L]

Interference – Division of wave front and division of amplitude - Two- and Multiple Beam Interference, Interference in parallel and wedge shaped films - Newton's rings - determination of wave length and thickness - Thin film Interference - Anti-reflection Coating – its application.

Diffraction – Fresnel and Fraunhofer diffraction - Single Slit, Double Slit and N-Slit Diffraction (Qualitative discussion only)

Polarization – Introductory discussion of Polarization – States of Polarization – Brewster's law – Malus Law – Phase Retardation Plate – Optical Activity

Lasers – Characteristics of Laser – Classification of Laser - construction and working - Einstein's coefficients – Example of Gas Laser, Solid state laser and semiconductor lasers - Applications of Laser

Module -3 [5L]

Statistical Mechanics

Phase Space (μ - and Γ -phase space) – Macrostates and Microstates – Density of States - Statistical Ensemble and Thermodynamic Probability

Classical Statistical systems (Maxwell-Boltzmann statistics) and quantum statistical systems (Fermi-Dirac and Bose-Einstein Statistics) and their applications

Module -4 [10L]

Quantum Mechanics

Blackbody Radiation – Stefan-Boltzmann law - Wein's displacement law - Wein's distribution law - Rayleigh-Jeans law - Ultraviolet catastrophe - Planck's Radiation law, Compton Effect, Dual Nature of Matter – De' Broglie hypothesis – Heisenberg's Uncertainty Principle – Group velocity and Phase velocity, Wave function – Postulates of Quantum Mechanics – Quantum Mechanical operator – Eigen function and Eigen value - Schrödinger's time dependent and time independent wave equation – Particle in 1D box – Particle in 3D box – Concept of degeneracy

Module -5[6L]

Dielectric Polarization

Fundamentals of Dielectric polarization – Macroscopic and microscopic field – Electronic, Ionic, Orientational and Space charge polarization (Qualitative overview) - dielectric loss - Loss tangent - Application of dielectric materials

Magnetic Properties

Fundamentals of magnetic properties – Classification (Dia, Para, Ferro, Anti-ferro, Ferri, Super-para) of magnetic materials – Curie temperature – Magnetic domain – Hysteresis – hard and soft magnetic materials – Applications of Magnetic materials

Course Outcomes (COs)

- CO1. Describe how different electronic tools, various parameters & variables of fundamental physics related to the programme. To overcome & eliminate different constraints those may arise by solving the physical and numerical problems.
- CO2. Overall enhancement of innovative problems solving ability by enhancing the power of knowledge and imagination.
- CO3. Describe the current research works and publications of the subjects in different fields adopted by the students as per course curriculum in various journals and literature.
- CO4. Describe how the ideas those are adopted can be implemented through projects and demonstrate various models, recent project proposals to execute the knowledge adopted from the course.
- CO5. Define how the ideas can be share with the multi - disciplinary personals. Lighten on the latest and modern developments in the fields.
- CO6. Explain about ethical awareness and impact in the field of environmental, social and safety of the finished products. Describe the pollution, legal aspects and impacts may arise in large scale production.

Learning Resources

1. Vector Analysis – M.R. Spiegel
2. Waves and Oscillation – N.k. Bajaj
3. Introduction to Classical Mechanics RTakwale, PPuranik, McGrawHill Education
4. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker, Wiley
5. Optics – A.K. Ghatak McGrawHill Education India Private Limited
6. Modern Physics for Scientists and Engineers, J.R. Taylor, C.D. Zafiratos and M.A. Dubson, 2nd Ed., Pearson (2007)
7. Modern Quantum Mechanics, J.J. Sakurai, Cambridge University Press
8. Solid State Physics, S.O. Pillai

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Paper Name: Chemistry-I	Category: Basic Science Course
Paper Code: BS-CH-101/BS-CH-201	Semester: First/ Second
L-T-P: 3-1-0	Credit: 4

Total Lecture: 42L

Course Objective

- To develop the interest among the students regarding chemistry and their applications in engineering
- To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field.

Module I [11L]

Thermodynamics: (6L)

Preliminary information on First Law of Thermodynamics (Principle, Molar Heat Capacity; Relation of C_p and C_v (for Ideal and Real Gas); Joule's Experiment, Joule-Thompson Coefficient, Throttling, Adiabatic Relationship); Second Law, Engine; Carnot's Cycle; Entropy, Entropy change; Entropy of system/surrounding/Universe; Free Energy, Free energy expression; Gibbs-Helmholtz equation; Clausius-Clapeyron equation; Maxwell relations.

Electrochemistry: (2L)

Cell construction; Primary and Secondary Cell; Nernst Equation; Relation with ΔG , ΔH and ΔS ; pH of Cell; Batteries; Fuel Cell

Chemical Kinetics: (3L)

Rate equation; Collision and Activation Theory; Temperature dependency; Complex Reaction; Parallel reaction; Consecutive reaction; Chain Reaction; Homogeneous and Heterogeneous Catalyst; Acid base catalysis; Enzyme Catalysis; Michaelis Menten equation.

Module II [8L]

Atomic structure: (3L)

Preliminary Accounts on Bohr-Sommerfeld model of the atom (Electronic configuration and Quantum numbers; Shapes of s , p , d , f orbitals - Pauli's exclusion principle - Hund's Rule of maximum multiplicity - Aufbau principle). Emission and absorption spectra, line and band spectra; Hydrogen spectrum - Lyman, Balmer, Paschen, Brackett and Pfund series; de-Broglie's hypothesis; Heisenberg's uncertainty principle - wave nature of electron - Schrodinger wave equation (No derivation). Eigenfunctions and eigenvalues.

Chemical bonding and Coordination Chemistry: (5L)

Elementary information on Chemical bonding including VBT, Shapes of molecules with hybridization, Valency shell electron pair repulsion (VSEPR) theory. Molecular orbital of diatomic molecules (e.g. H_2 , O_2 , N_2 , CO , HF , CN^- , NO^+). Pi-molecular orbital of butadiene and benzene. Crystal field theory of coordination compounds - magnetism, spin and orbital

contribution, quenching of magnetic moment: d-d transitions, color. Metallic bond – concept of conductor, semiconductor, insulator; photoelectric effect.

Module III [7L]

Organic Spectroscopy (7L)

UV-Visible Spectroscopy: Types of electronic transitions, chromophores and auxochromes; Bathochromic and Hypsochromic shifts; intensity of absorptions (Hyper-/Hypochromic effects); application of Woodward's Rules for calculation of λ_{\max} for the following systems: conjugated dienes, relative positions of λ_{\max} considering conjugative effect, steric effect, solvent effect.

IR Spectroscopy: Introduction; modes of molecular vibrations (fundamental and non fundamental); IR active molecules.

NMR Spectroscopy: Basic principles of Proton Magnetic Resonance; NMR active molecules; equivalent and non-equivalent protons with examples; chemical shift. Significance of the terms: up-/downfield, shielded and deshielded protons.

Fluorescence, phosphorescence and their application.

Mass Spectroscopy: Introduction; Principles, Ion sources, Fragmentation and analysis of mass spectra.

Module IV [6L]

Polymer (3L)

Molecular weight of Polymers (number average, weight average, viscosity average), Polymerization processes (addition and condensation), Mechanism of addition polymerization (free radical, cationic, anionic, coordination), Poly Dispersity Index (PDI), Degree of Polymerization, Stereo-regularity of polymers (crystallinity and amorphicity). Vulcanization. Conducting, semi-conducting polymers and doping.

Corrosion (3L)

Types of corrosion (dry, wet), Pitting corrosion, Crevice corrosion, Galvanic series, Stress corrosion cracking, Corrosion of polymers. Protection from Corrosion (Surface treatments, Reactive coatings, Anodization, Biofilm coatings) Sacrificial anode protection, Rust removal, Passivation, Water treatment (waste, surface), Alkalinity, Scale-sludge.

Module V [6L]

Stereochemistry (4L)

Different types of isomerism; concept of chirality and optical activity (upto two carbon atoms); elements of symmetry [plane (σ), center (i) and alternating axis (S_n) of symmetry]; interconversion of Fischer and Newman representations; threo and erythro, D and L, CIP Rules: R/S (upto 2 chiral carbon atoms), E/Z nomenclature. Conformational analysis of ethane, *n*-butane.

Structure and reactivity of Organic molecule (2L)

Molecular Effects: Inductive, resonance, hyper conjugation, steric effects. Oxidation and reduction reactions for organic compounds. Some name reactions: Aldol, Cannizzaro, Michael, Claisen-Schmidt, Wittig reactions.

Module VI [4L]

Elementary Chemical Biology:

Origin of Life and Chemical Elements; Role of concentration of ions/small molecules in the growth profile of cells; Trace and Ultratrace elements; Basic Biomolecules, Elementary reactions in the biological system and roles of metal ions. Function of Fe (with special reference to Hemoglobin and Myoglobin) and Cu (with special reference to Hemocyanin) in Biological system. Toxicity of Hg, As, Pb, F, P(V). Synthesis of some commonly used drug molecules (Aspirin, Paracetamol, Salbutamol and Ibuprofen). Synthesis of some commonly used Pesticides and Insecticides in Agriculture: DDT, Dieldrin/Lindane (organochlorine group), Parathion (organophosphate group) and Carbaryl (carbamate group).

Course Outcomes (COs)

- CO1. To memorize the elementary topics of chemistry such as chemical thermodynamics, atomic structures, electromagnetic spectroscopy, corrosion chemistry, electrochemistry, organic reactions and synthesis of drug molecules.
- CO2. To acquire knowledge on the fundamental concepts of chemical thermodynamics, atomic structures, electromagnetic spectroscopy, corrosion chemistry, electrochemistry, organic reactions, polymers and synthesis of drug molecules.
- CO3. Making use of concepts of drug molecules, polymer chemistry, corrosion chemistry and battery technology to meet day to day necessities including application of the organic synthesis, Maxwell's equations, spontaneity and equilibrium reactions etc.
- CO4. analyse versatile and novel problems and sorting them out, covering all the topics of the entire course.
- CO5. rationalize, explain and corroborate several chemical problems, determine the most plausible approach of solving real life interdisciplinary chemical complications.
- CO6. To construct a purposeful and efficient model through which learners can be able to develop and solve trivial as well as up to date problems recognized by academia, researchers and industries.

Learning Resources

1. P.C. Rakshit, Physical Chemistry, Sarat Book House
2. S. Pahari, Physical Chemistry, New Central Book Agency
3. P.W. Atkins, & Paula, J. de Atkins, Physical Chemistry, Oxford University Press
4. J.D. Lee, Concise Inorganic Chemistry, 5th Ed., Wiley India Pvt. Ltd.
5. F.A. Cotton, G. Wilkinson, and P.L. Gaus, Basic Inorganic Chemistry 3rd Ed.; Wiley India.
6. J.E. Huheey, E.A. Keiter, & R.L. Keiter, Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson, 2006.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

7. J. Clayden, N. Greeves, S. Warren, Organic Chemistry, Second edition, Oxford University Press.
8. S. Sen Gupta, Reaction Mechanisms in Organic Chemistry, Oxford University Press
9. L. Finar, Organic Chemistry (Volume 1) Pearson Education.
10. R. N. Morrison, & R. N. Boyd, Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
11. D. Nasipuri, Stereochemistry of Organic Compounds, Wiley Eastern Limited.
12. E. L. Eliel, & S. H. Wilen, Stereochemistry of Organic Compounds, Wiley: London, 1994.
13. B. K. Sharma, Industrial Chemistry (including Chemical Engineering), GOEL Publishing House

Paper Name: Programming for Problem Solving	Category: Engineering Science Course
Paper Code: ES-CS-101/ES-CS-201	Semester: First/ Second
L-T-P: 3-1-0	Credit: 4

Total Lecture: 40L

Course Objectives

- To introduce to students to the field of programming using language.
- To enhance their analyzing and problem solving skills.

Module 1 [12L]

Unit 1: Introduction to Programming (4 L)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples.

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

Unit 2: Arithmetic expressions and precedence (2L)

Unit 3: Conditional Branching and Loops (6 L)

Writing and evaluation of conditionals and consequent branching
 Iteration and loops

Module 2 [12L]

Unit 1: Arrays (6L)

Arrays (1-D, 2-D), Character arrays and Strings

Unit 2: Basic Algorithms (6L)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module 3 [9L]

Unit 1: Function (5L)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 2: Recursion (4L)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Module 4 [7 L]

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Unit 1: Structure (4L)

Structures, Defining structures and Array of Structures

Unit 2: Pointers (2L)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list, dynamic memory allocation, Union (no implementation)

Unit 3: File handling (1L)

Basic idea about read, write, append operation if time is available, otherwise should be done as part of the lab)

Course Outcomes (COs)

CO1. To formulate simple algorithms for arithmetic and logical problems.

CO2. To test and execute the programs and correct syntax and logical errors. CO3. To implement conditional branching, iteration and recursion.

CO4. To decompose a problem into functions and synthesize a complete program using divide and conquer approach. To use arrays, pointers and structures to formulate algorithms and programs.

CO5. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

CO6. To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Learning Resources

1. R.S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. Balaguruswamy, Programming in ANSIC, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Paper Name: Basic Electrical and Electronics Engineering	Category: Engineering Science Courses
Paper Code: ES-EE101/ES-EE201	Semester: First/ Second
L-T-P: 3-1-0	Credit: 4

Total Lecture: 45L**Course Objectives**

- To understand the impact of technology in a global and societal context.
- To provide working knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices.

Module 1 [3L]**Electromagnetism:**

Magnetic circuits, Analogous quantities in magnetic and electric circuits, Faraday's law, self and mutual inductance, Hysteretic and Eddy current losses, Self and Mutual inductance, B-H loop, Hysteresis and Eddy current loss

Module 2 [10L]**Circuits Analysis**

DC Network Theorem: Definition of electric circuit, network, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit. Kirchhoff's law. nodal analysis, mesh analysis. Principle of superposition. Source equivalence and conversion, Thevenin's theorem, Norton Theorem, AC fundamental: Production of alternating voltage, waveforms, average and RMS values, peak factor, form factor, phase and phase difference, phasor representation of alternating quantities, phasor diagram, behavior of AC series circuits, power factor, power in AC circuit.

Module 3 [6L]**Transformers**

Single phase transformer: Core and shell type construction, ideal and practical transformer, EMF equation, no load and on load, operation, phasor diagram and equivalent circuit, losses of a transformer, open and short circuit tests, regulation and efficiency calculation, Auto-transformer.

Module 4 [10L]**Electrical Machines**

DC Machine : Construction, working, torque speed characteristic and speed control of separately excited dc motor.

AC Machine: Construction, Generation of rotating magnetic fields and working of a three-phase induction motor, Torque-slip characteristic, Brief idea about Single Phase Induction Motor and Synchronous generators

Module 6 [8L]**Transistors**

Transistor Biasing and Bias stability: calculation of stability factor with variation of I_{CO} Different operating modes; CE, CB, CC and their properties; small signal low frequency operation of transistors; equivalent circuit parameters as a two port network. Transistors as amplifier:

expression of voltage gain, current gain, input impedance and output impedance, frequency response for CE amplifier with and without source impedance (qualitative)

Module 7 [5L]

Field Effect Transistor

Construction and characteristics of JFET (N channel only), Transfer characteristics; construction and characteristics of MOSFET (N channel only), depletion and enhancement type; CS, CG, CD configuration

Module 8 [3L]

Operational Amplifier

Concept of virtual earth, inverting and non-inverting mode of operation, voltage summing, difference, constant gain multiplier, voltage follower, comparator, integrator, differentiator.

Course Outcomes (COs)

- CO1. To acquire knowledge of different theorems for electric and magnetic circuits analysis. Explain the working principle, construction, applications of Transformer, DC machines, AC machines. Concept of 3 phase power, JFET, MOSFET, OPAMP, sinusoidal voltages and currents in different machines and circuits. Explain fundamental laws and theorems governing the working different electrical machines and circuits. Able to identify the procedures for calculations of different circuit parameters.
- CO2. Use the concepts of applying mathematics and science principles, trigonometry, complex algebra, phasor operations to provide solution of different simple problems; critical circuit problems related to electrical systems.
- CO3. Analyze series circuits, flow of currents, algebraic sum of voltages (voltage drops) in any closed path in a circuit to examine the behavior of electric circuits and performance characteristics and efficiency of electrical machines.
- CO4. Evaluate and judge whether the solutions obtained are correct and matches the required parameters and characteristics.
- CO5. Use the knowledge acquired to investigate unknown problems and design and assemble to find a solution to the problem.

Learning Resources

1. Basic Electrical Engineering, D.P. Kothari & I.J. Nagrath, TMH, Second Edition
2. Basic Electrical Engineering, V.N. Mittle & Arvind Mittal, TMH, Second Edition
3. Basic Electrical Engineering, Nath & Chakraborti
4. Electrical Technology, Vol-I, Vol-II, Surinder Pal Bali, Pearson Publication
5. A Text Book of Electrical Technology, Vol. I & II, B.L. Theraja, A.K. Theraja, S.Chand & Company
6. Electrical Engineering Fundamentals, Vincent Del Toro, Prentice-Hall
7. Advance Electrical Technology, H. Cotton, Reem Publication
8. Basic Electrical Engineering, R.A. Natarajan, P.R. Babu, Sictech Publishers
9. Basic Electrical Engineering, N.K. Mondal, Dhanpat Rai

Paper Name: Basic Electrical and Electronics Laboratory	Category: Engineering Science Courses
Paper Code: ES-EE191/ES-EE291*	Semester: First/ Second
L-T-P: 0-0-3	Credit: 1.5

Course Objectives:

CO 1: Analyse fundamental theoretical concept, laws and theorems of Basic Electrical Engineering-I through experimental set up.

CO2: Identify and use of various electrical measuring devices.

CO 3: Practice different types of wiring and devices connections keeping in mind technical and economical safety issues.

CO 4: Evaluate and judge whether the solutions obtained are correct and matches the required parameters and characteristics.

CO 5: Familiarize with different active and passive electronic and electrical components, Trainer Kit, Function Generator, CRO and different measuring equipments and apply network theorems on DC and AC networks and Choose the proper type and specification of measuring procedure and measuring instruments for different industrial/commercial/domestic applications.

CO6: Examine various real life situations in domestic or industrial scenario where measurements of electronics and electrical quantities are essential without measuring equipments i.e. alternate process of identification and characterization of components and build up the ability to work in a team to complete the task within a fixed time limit and proper resource utilization taking different responsibility with fully cooperation with other team mates

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions.
 - a) Introduction and uses of Voltmeter, ammeter, Wattmeter and Auto-transformer.
 - b) Introduction and uses of components of LT switchgear (MCB and different types of fuses .
2. Introduction and uses of following instruments:
 - a) Multimeter (b) Oscilloscope and (c) Function Generator. Demonstration of real life resistors, capacitors, inductors with color code .
3. Calibration of ammeter and Wattmeter.
4. Observation of voltage phase differences of R-L and R-C series circuit when a pure sinusoidal supply is applied across it.
5. Open circuit and short circuit test of a single-phase transformer.
6. Connection and measurement of power consumption of a fluorescent lamp.
7. Voltage-current characteristic of incandescent lamps.
8. Measurement of power in a three phase unbalanced circuit by two wattmeter

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

method.

9. Determination of Torque – Speed characteristics of separately excited DC motor.
10. Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
11. Verification of Thevenin's Theorem.
12. Verification of Norton's Theorem.
13. Verification of Superposition Theorem.
14. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Integrators and Differentiators.

Text Books:

1. Basic Electrical Engineering, D.P. Kothari & I.J. Nagrath, TMH, Second Edition
2. Basic Electrical Engineering, V.N. Mittle & Arvind Mittal, TMH, Second Edition
3. Basic Electrical Engineering, Nath & Chakraborti
4. Electrical Technology, Vol-I, Vol-II, Surinder Pal Bali, Pearson Publication
5. A Text Book of Electrical Technology, Vol. I & II, B.L. Theraja, A.K. Theraja, S. Chand & Company

Reference Books:

1. Electrical Engineering Fundamentals, Vincent Del Toro, Prentice-Hall
2. Advance Electrical Technology, H. Cotton, Reem Publication
3. Basic Electrical Engineering, R.A. Natarajan, P.R. Babu, Sictech Publishers
4. Basic Electrical Engineering, N.K. Mondal, Dhanpat Rai

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Paper Name: English Language and Technical Communication	Category: Humanities and Social Sciences including Management course
Paper Code: HM-HU101/HM-HU201	Semester: First/ Second
L-T-P: 2-0-0	Credit: 2

Total Lecture: 32L

Course Objectives

- To acquire language skills,
- to develop linguistic and communicative competencies for Engineering students.
- to study academic subjects more effectively using the theoretical and practical components of English syllabus, and hence will develop study skills and communication skills in formal and informal situations.

Module 1: Theories of Communication [6L]

Theories and Principles of Communication: Definition, Process, Model (Schematic diagram of Shannon and Weaver's Model of Communication), Types of Communication – Verbal and Non-verbal communication, Flows of communication

Barriers to communication

Workplace/Business Communication which can have the following items:

- a) Scope of Oral Communication
- b) Oral Business Communication: Introducing oneself in a professional setup - brevity, context, understatement, body language –
Task: Introducing others - introducing a junior professional to a senior professional, introducing an employee to a customer, introducing a colleague from your firm to an employee of another firm.
- c) Telephone (audio and video) communication: choice of words, body language, paralinguistic elements of speech, enunciation, brevity, clarification, effective closure

Module 2: Applied Grammar [9L]

Common Errors in English

- Subject-verb agreement
- Tenses
- Noun-pronoun agreement
- Articles and Prepositions
- Misplaced or dangling modifiers
- Redundancies
- Cliché

Transformation of Sentences

- Active and Passive voice
- Direct and Indirect speech
- Degrees of Comparison

Use of phrases and clauses in sentences

Synthesis of Sentences: Simple, Complex and Compound

Module 3 Vocabulary Building [3L]

The concept of word formation: Compounding, Backformation, Clipping and Blending Root words from foreign languages and their use in English

Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

Synonym, antonym, phrasal verbs, one word substitution and standard abbreviation

Module 4 Basic Writing Skills [4L]

Documenting: definition, meaning, basic concept of documenting (print and online media), types of technical documents

Importance of proper punctuation

Creating coherence: Arranging paragraphs & sentences in logical order

Cohesion: Organizing principles of paragraphs in documents Techniques for writing precisely

Module 5 Professional Writing Skills [10L]

Technical Report Writing: Types and formats

Comprehension, Précis and Expansion Writing, Essay Writing, Writing SOPs and Project Proposals.

Business Letters; Cover letter & CV

Office Correspondence:

- Notice
- Agenda
- Minutes
- Memo
- E-mail

Course Outcomes (COs)

CO1. Understanding the mechanism of interpretation through language learning by practicing reading, writing and comprehension skills.

CO2. Understanding complex engineering problems by a sound grammatically correct knowledge of the English Language & honing writing, and reading skills for software research, solutions, marketing etc.

CO3. Equipping learners to solve various problems related to aptitude test through the practice of various Verbal reasoning and grammar practice.

CO4. Development of analytical thinking through practice of analytical essays, business correspondence.

CO5. Learning effective communication strategies for handling criticism and adverse remarks and also knowing strategies of effective intervention, kinesics and courtesies and different components of soft skills.

CO6. Awareness about the society, public health and safety, growth and changes in society, culture and environment through comprehension, technical report writing practice.

Learning Resources

1. Connect: A Course in Communicative English by Debashis Bandyopadhyay and Malathy Krishnan. Cambridge University Press. 2018.
2. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2015.
3. Communication Skills for Professionals. Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
4. High School English Grammar by Wren and Martin
5. Common Errors in English by S. Prasad & K.P. Thakur, Bharti Bhhawan Publishers
6. Business Correspondence and Report Writing – R.C. Sharma and Krishna Mohon, Tata McGraw-Hill Publishing company Ltd., New Delhi
7. English Vocabulary in Use- McCarthy
8. Communicative English – E. Sureshkumar and P. Sreehari – Orient Blackswan, 2007
9. Speaking Effectively, Developing Speaking Skills for Business English, Jeremy Comfort- Cambridge University Press, 1994
10. Practical English Usage. Michael Swan. OUP. 1995.
11. Remedial English Grammar. F.T. Wood. Macmillan. 2007
12. A Practical English Grammar – A.J. Thomson, A. V. Martinet – Oxford University Press
13. Guide to writing as an Engineer, John Willey- David F. Beer and David McMurrey, New York, 2004

Paper Name: Physics Laboratory – I	Category: Basic Science Course
Paper Code: (BS-PH-191 & BS-PH-291)	Semester: First/ Second
L-T-P: 0-0-3	Credit: 1.5

Periods: 36P

Course Objectives

- To provide exposure to the students with hand on experience for data acquisition, precession, statistical data analysis, graph plotting calculation of fundamental quantities and error estimation of different fundamental physics experiments relevant to various engineering discipline.

All students have to perform total 9 experiments taking at least one from Optics, Electricity & Magnetism, Quantum Mechanics, Miscellaneous experiments and Innovative experiment sections. (One Innovative experiment is mandatory)

List of Experiments

Optics Experiments

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method
5. Determination of numerical aperture, angle of acceptance and bending energy losses of an optical fiber

Electricity & Magnetism Experiments

1. Determination of thermoelectric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thomson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
6. Determination of unknown resistance using Carey Foster's bridge
7. Study of Transient Response in LR, RC and LCR circuits using ExpEYES
8. Generating sound from electrical energy using ExpEYES

Quantum Physics Experiments

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous Experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseuille's capillary flow method
7. Measurement of wavelength and velocity of Ultrasonic wave by using Ultrasonic Interferometer.

Innovative Experiments

1. Studies on Band gap measurement of thin film using UV-VIS spectrophotometer.
2. Basic UV-VIS absorbance study of organic dyes.
3. Basic UV-VIS study of nano-particles (NPs) and quantum dots (QDs).
4. Basic photoluminescence study of organic dyes.
5. Basic photoluminescence study of nano-particles (NPs) and quantum dots (QDs).
6. Studies on Basics of Vacuum system and Vacuum measurements.

Course Outcomes (COs)

- CO1. Describe the various aspects, parameters, scales of experimental tools and design to conduct the experiments in the laboratory.
- CO2. Analyze the methods of experiments and interpret the output results. Emphasis on the limitations of theoretical concepts, measuring instruments to perform the experiments and deviation of results from ideal one.
- CO3. Describe the needs of publication of the outcome results and correlate the results with published papers in various journals and literature in the respective fields.
- CO4. Describe how the ideas those are adopted can be implemented through projects and demonstrate various models, recent project proposals to execute the knowledge adopted from the course.
- CO5. Define how the ideas can be shared with the multi-disciplinary personals. Lighten on the latest and modern developments in the fields.
- CO6. Explain about ethical awareness and impact in the field of environmental, social and safety of the finished products. Describe the pollution, legal aspects and impacts may arise in large scale production.

Learning Resources

1. B.Sc. Practical Physics – C.L. Arora
2. B.Sc. Practical Physics – Harnam Singh and Dr. P.S. Hemne – S. Chand

Paper Name: Chemistry Laboratory – I	Category: Basic Science Course
Paper Code: (BS-CH-191 & BS-CH-291)	Semester: First/ Second
L-T-P: 0-0-3	Credit: 1.5

Periods: 36P

Course Objective

- To be able to design, carry out, record and analyze the results of chemical experiments.
- To demonstrate creative and independent thinking in both learning and work environments.
- To be able to use modern instrumentation and classical techniques, to design experiments and to properly record the results of their experiments.

Name of the Experiments

1. Preparation of Phenyl and Hand Sanitizer owing to its disinfectant and germicidal values.
2. Determination of the partition coefficient of a substance between two immiscible liquids.
3. Complexometric titration for determination of calcium and magnesium hardness of water.
4. Conductometric and pH-metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
5. Determination of dissolved oxygen present in a given water sample.
6. Determination of chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
7. Determination of percentage composition of sugar solution by viscosity measurement method.
8. Saponification/acid value of oil.
9. Preparation of some useful organic compounds: Phthalimide, Aspirin
10. Study on Thin layer chromatography
11. Preparation of some useful polymer: PF resin, MF resin.

Course Outcomes (COs)

- CO1. To be able to design, carry out, record and analyze the results of chemical experiments. Students will demonstrate laboratory skills and show understanding in all major laboratory techniques and principles including instrumentation, synthesis, purification, analysis including green chemistry.
- CO2. To be skilled in problem solving, critical thinking and analytical reasoning. To operate a range of chemical instrumentation with adequate hands-on experiences.
- CO3. To be able to use modern instrumentation and classical techniques, to design experiments and to properly record the results of their experiments.
- CO4. To be able to use appropriate literature research and go through journal articles for

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

useful information. Students will show proficiency at scientific communication including posters, presentations, laboratory reports and even journal articles.

CO5. To demonstrate creative and independent thinking in both learning and work environments. Work independently and collaborate effectively with other people in a team. Self-evaluate their own learning progress and develop motivation and learning skills for lifelong learning.

CO6. To learn the value of a professional work ethic including working as part of a diverse team. They will develop the ability to recognize ethical issues related to the impact of technological advances on society.

Learning Resources

1. A.I. Vogel, Elementary Practical Organic Chemistry, Part 2: Qualitative Organic Analysis, CBS Publishers and Distributors.
2. A.K. Nad, B. Mahapatra, A. Ghoshal, An Advanced Course in Practical Chemistry, New Central Book Agency; 3rd edition.
2. University Handbook of Undergraduate Chemistry Experiments, edited by Mukherjee, G.N. University of Calcutta, 2003.
3. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012).
4. H. T. Clarke, A Handbook of Organic Analysis (Qualitative and Quantitative), Fourth Edition, CBS Publishers and Distributors (2007).
5. Practical Workbook Chemistry (Honours), UGBS, Chemistry, University of Calcutta, 2015.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Paper Name: Programming for Problem Solving	Category: Engineering Science Course
Paper Code: ES-CS-191/ES-CS-291	Semester: First/ Second
L-T-P: 0-0-3	Credit: 1.5

Periods: 36P

Course Objectives

- To formulate and test simple algorithms for arithmetic and logical problems, execute the programs and correct syntax and logical errors for implementing conditional branching, iteration and recursion.

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given

Tutorial 1: Problems solving using computers:

Lab 1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D Arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 & 9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

Course Outcomes (COs)

CO1. To formulate simple algorithms for arithmetic and logical problems.

To translate the algorithms to programs (in C language).

CO2. To test and execute the programs and correct syntax and logical errors.

To implement conditional branching, iteration and recursion.

CO3. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering

(Applicable from the academic session 2023-2024)

- CO4. To use arrays, pointers and structures to formulate algorithms and programs.
- CO5. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- CO6. To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Paper Name: Workshop Practice	Category: Engineering Science Course
Paper Code: ES-ME191/ES-ME291	Semester: First/ Second
L-T-P: 1-0-3	Credit: 2.5

Periods: 39P

Course Objectives

- To give the basic working knowledge required in various engineering based constructions, function, use and application of different working tools, equipment, and machines as well as the technique of manufacturing a product from its raw material.

[Before practice, background lectures will be delivered on the topics. Tool specifications and their materials will be described. Brief reports on the work done will be submitted by the students and evaluation will be made on the basis of examination of the report and viva, conducted by the teachers.]

Theory

1. Carpentry (Wood Working)

Timber, Seasoning and Preservation, Plywood and Plyboards, Carpentry Tools, Engineering applications. Different Joints

2. Metal Joining

Definitions of welding, brazing and soldering processes, and their applications. Oxy-acetylene gas welding process, equipment and techniques. Types of flames and their applications. Manual metal arc welding technique and equipment. AC and DC welding, electrodes, constituents and functions of electrodes. Welding positions. Types of weld joint. Common welding defects such as cracks, slag inclusion and porosity.

3. Benchwork and Fitting

Tools for laying out, chisels, files, hammers, hand hacksaw, their specifications and uses.

4. Metal Cutting

Introduction to machining and common machining operations. Cutting tool materials, geometry of cutting tool, cutting fluid. Definition of machine tools, specification and block diagram of lathe, shaper, milling, drilling machine and grinder. Common lathe operations such as turning, facing and chamfering and parting. Difference between drilling and boring. Use of measuring instruments like micrometer / vernier caliper.

5. Tin Smithy

Sheet metal introduction, tools and operations, Shearing and Bending of sheets, types of joints

Job to be made in the Workshop

Group A (6P)

Carpentry Shop: T-Lap joints and Dovetail joint

Group B (6P)

- a. Gas Welding practice on mild steel flat/sheet (upto 3mm thick)
- b. Lap joint by Gas Welding (upto 3mm thick)
- c. Manual Metal Arc Welding practice (upto 5mm thick)
- d. Square butt joint by MMA Welding
- e. Lap joint by MMA Welding

Group C

Fittings work: Sawing and Finishing by Filing. (6 P)

Group D

- a. Job on lathe with turning, facing, chamfering and parting operations (6P)
- b. Job on shaper and milling machine for finishing two sides of a job (6P)
- c. Drilling of holes of size 5 and 12 mm diameters on the jobs / External threads making by dies, Tap size drill hole/ hand tapping operations

Group E

Smithy-making simple products on sheet metal (6P)

Course Outcomes (COs)

- CO1. Define, describe and determine the types and nature of the physical parameters like cutting speed, feed, depth of cut etc applied on mechanical manufacturing systems.
- CO2. Classify and explain the effects of the above physical parameters as applied on mechanical manufacturing systems for proper comprehension.
- CO3. Train the students in metal joining process like welding, soldering, etc CO4. Impart skill in fabricating simple components using sheet metal
- CO5. Cultivate safety aspects in handling of tools and equipment
- CO6. Develop the collective skill and potentiality and leadership quality to work in a group or team.

Learning Resources

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. and Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering

(Applicable from the academic session 2023-2024)

3. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology-I" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
5. Rao P. N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Haldia Institute of Technology
 (An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)
Syllabus for B. Tech in Agricultural Engineering
 (Applicable from the academic session 2023-2024)

Paper Name: Engineering Drawing	Category: Engineering Science Course
Paper Code: ES-ME192/ES-ME292	Semester: First/ Second
L-T-P: 1-0-3	Credit: 1.5

Periods: 42P

Course Objectives

- To teach students to communicate using **graphic** techniques.
- To accomplish the principles and standards of mechanical **drawing** and dimensioning.

[Sessional work should be completed in the class. Problems sheet will be provided. Students should attempt to solve the problems given in the Problem Sheet. Home assignments will be given. Evaluation will be made on the basis of seasonal work and viva-voce examination.]

Scales (3P)

Plainscales, Diagonal scales, Vernier scales

Geometrical Construction and Curves (3P)

Conic Section: Parabola, Hyperbola, Ellipse

Projection of Points, Lines, Surfaces (9P)

Orthographic Projection – First angle and third angle projection More no. of problems should be practiced in first angle projection. Projection of lines inclined to the planes Projection of surfaces Pentagon, Hexagon

Projection of Solids (12P)

Cube, Pyramid, Prism, Cylinder, Cone, Frustums

Isometric View And Isometric Projection (6P)

(Prism, Pyramid, Cylinder, Cone and examples of simple solid objects/ models).

Sectional Views of Solids, True Shape of a Section (6P)

Development of Surfaces (3 P)

(Cube, Prism, Cylinder, Truncated Cone)

Course Outcomes (COs)

- CO1. To represent pictorially different elements and components using basic engineering drawing guidelines.
- CO2. To gain significance of scaling pertinent to engineering drawing problems. The incumbents should also have knowledge about analytical curves and their relevance to understand different higher level mechanical engineering problems.
- CO3. To understand the concept of projections for 1D, 2D and 3D object representation.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

CO4. To develop an idea and ability to view complex interior sections of a solid object, and they will also be able to analyze and explain how different surfaces are generated when a solid object is cut along a plane and its surfaces are stretched out.

CO5. To draw isometric to orthographic views and vice versa.

CO6. To apply the comprehensive knowledge by using a suitable computer aided drafting package.

Learning Resources

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3. Agrawal B. & Agrawal C.M. (2012), Engineering Graphics, TMH Publication
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
5. Narayana, K.L. & P. Kanniah (2008), Textbook on Engineering Drawing, Scitech Publishers
6. Corresponding set of CAD Software Theory and User Manuals

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Paper Name: Language Laboratory	Category: Humanities and Social Sciences including Management
Paper Code: HM-HU191/ HM-HU291	Semester: First/ Second
L-T-P: 0-0-2	Credit: 1

Periods: 22P

Course Objectives

- To provide advanced skills of Technical Communication in English through various activities performed in the Language Lab Practice Sessions to 1st Semester U.G. students of Engineering and Technology.
- To instil confidence in them so that they can competently communicate in English language in all spheres.
- To make them efficient enough to communicate about day-to-day events and experiences of life, comprehend lectures delivered in English, read and understand relevant materials written in English and also to write grammatically correct English.
- To make them capable of shedding their fear of communication and public speaking.

List of Experiments

1. Developing active 'Listening Skill' and its sub skills through Language Lab Audio device; (Listening to conversations, passages, stories, news bulletin, speeches by famous personalities – Listening for general and specific information etc.,) (3P)
2. Developing 'Speaking Skill' and its sub skills; (Interpersonal Communication, Oral Presentations — Debate – Extempore – Speech Presentation – Conversational Practice – Face to Face / Telephonic Conversation) (5P)
3. Developing 'Reading Skills' and its sub skills through reading excerpts from plays, poetry, news and various technical/non technical passages using Visual / Graphics/Diagrams / Chart Display etc. and using Literary text(s):
The Homecoming by Rabindranath Tagore
We're Not Afraid to Die...if We're Together by Gordon Cook and Alan East (4P)
4. Developing 'Writing Skill' and its sub skills by using Language Lab Audio – Visual input; Practice Sessions (Analytical essay writing, dialogue writing, story writing, etc.) (3P)
5. Pronunciation: Basic Rules (with emphasis on Accent Neutralisation)
Organs of Speech (2P)
6. Introducing 'Group Discussion' through audio – Visual input and acquainting them with key strategies for success; GD practice sessions (unstructured and structured) (4P)
7. SWOT Analysis (1P)

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Learning Resources

1. Nira Konar: English Language Laboratories, A Comprehensive Manual, PHI Learning Pvt. Ltd.
2. Dr. D. Sudharani: Manual for English Language Laboratory. Pearson Education (WB edition), 2010
3. Board of Editors: Contemporary Communicative English for Technical Communication, Pearson Longman, 2010
4. A Textbook of English Phonetics for Indian Students, T. Balasubramanian, Macmillan India Ltd.
5. Communicative English – E. Suresh Kumar and P. Sreehari – Orient Blackswan, 2007
6. Speaking Effectively, Developing Speaking Skills for Business English, Jeremy Comfort- Cambridge University Press, 1994
7. Pocket Style Manual - Diane Hacker, Bedford Publication, New York, 2003. (ISBN 0312406843)

Course Outcome (COs)

- CO1. Improving comprehension ability in English & understanding the mechanism of interpretation through language learning.
- CO2. Honing conversation skills by learning to substantiate conclusions in grammatically correct English
- CO3. Honing 'Reading Skills' and its subskills using Visual/Graphics/Diagrams/Chart Display/Technical/Non Technical Passages; Learning Global / Contextual / Inferential Comprehension for technical competence.
- CO4. Learning effective, real life communication skills in English through several language lab activities pertaining to the four basic skills of LSRW
- CO5. Learning basic soft skills and leadership qualities
- CO6. Engaging the learner in a positive and imaginative environment to hone socio-cultural, ethical and moral skills.

Paper Name: NSS	Category: Universal Human Value
Paper Code: XC-181	Semester: First/ Second
L-T-P: 0-0-2	Credit: 0

Periods: 24P

Course Objectives

- To create awareness for women's education, old age education saving of girl child. Medical issue-blood donation and Thalassemia test.
- To realize, synthesize, and evaluate their personal readiness for leadership by group work, communicating effectively and to overcome & eliminate different constraints those may arise in their academic and daily life.

1. Creating Awareness in Social Issues

Blood Donation Camp, Road Safety Awareness, Poster Competition (Saving of Girl child, saving of water and fuel for future, Pollution and control, Global warming, Equal education for girls), Thalassemia awareness Programme, Eye Check-Up Camp.

2. Participating in Mass-Education Programme

- a. Poster Presentation on Education for All
- b. Elocution competition, SA writing on education for all
- c. National Education Day celebration (11th Nov)

3. Proposal for Local Slum Area Development

- a. Road and Costal Side Cleaning Programme
- b. Local Hospital Area Cleaning Programme (with collaboration Haldia Municipality)
- c. Campus Cleaning Programme

4. Environmental Awareness Programme

- a. Resource Conversation (By Poster Competition)
 - i. Water
 - ii. Energy
- b. Poster Competition on Global warming
- c. Plantation Programme (5th September)
- d. Fire Safety Awareness Programme (With Haldia Fire Station)

5. Relief and Rehabilitation work during Natural Calamities

Course Outcomes (COs)

CO1. To Create awareness for women's education, old age education saving of girl child. Medical issue-blood donation and Thalassemia test.

CO2. To Realize, synthesize, and evaluate their personal readiness for leadership by group work, communicating effectively and to overcome & eliminate different constraints those may arise in their academic and daily life.

CO3. To Define and correlate different kind of social, cultural and ethical issue in light of saving of girl child, women education, saving of fuel. Manifest an ethics and

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

service to the nation as a fundamental duty by organizing seminar symposia, work shop, essay writing, poster presentation etc.

CO4. To Apply problem solving skills by taking on volunteer and community service in their professional and social life and show interest to think about eco-friendly projects for the betterment of the society.

CO5. To Recognize the importance of civic engagement and community activism through volunteerism, community and campus service, team projects.

CO6. To Realizing his/her importance and duty, feel interest about ethical awareness and impact in the field of environmental, social and safety of the finished products.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

**Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)****Curriculum Structure****SEMESTER-III**

Theory							
Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Engineering Thermodynamics & Heat Engines	ES-AE 301	100	3	0	0	3
2	Surveying and Levelling	ES-AE 302	100	3	0	0	3
3	Fluid Mechanics and Open Channel Hydraulics	PC-AE 301	100	3	0	0	3
4	Agriculture for Engineers	PC-AE 302	100	3	0	0	3
5	Professional Ethics & IPR	HM-AE 301	100	3	0	0	3
Total Marks: 500				Total Credit: 15			
Practical/Sessional/Tutorial							
1	Surveying and Levelling Lab	ES-AE 391	100	0	0	3	1.5
2	Fluid Mechanics Lab	PC-AE 391	100	0	0	3	1.5
3	Report Writing	SI-AE 381	100	0	2	0	2
4	NSS		100	0	0	3	0
Total Marks: 300				Total Credit: 5			
Total Credit						20(15+5)	

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Theory:

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Engineering Thermodynamics & Heat Engines	ES-AE 301	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge of students in the area of Engineering Thermodynamics.
2. To depict the theory and applications of laws of thermodynamics and thermodynamic Properties.

Pre-requisite:

1. Physics
2. Mathematics
3. Chemistry

Unit	Contents	Hrs./Unit
1	Fundamentals of thermodynamics (System, heat, work, internal energy, entropy, first law), and its practical significance/applied to elementary processes, Limitations of the first law of thermodynamics, Second law, concepts of heat engines and heat pumps, refrigeration, Kelvin-Planck and Clausius statements and their equivalence; reversible and irreversible processes; Carnot cycle and Carnot principles/theorems; thermodynamic temperature scale; Clausius inequality and concept of entropy; the principle of increase of entropy, T-s diagrams; second law analysis of control volume; availability and irreversibility; Third law of thermodynamics.	12

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

2	Properties of Pure Substances Thermodynamic properties of pure substances in solid, liquid and vapor phases; P-v-T behavior of simple compressible substances, phase rule, thermodynamic property tables and charts, ideal and real gases, ideal gas equation of state and van der Waals equation of state; law of corresponding states, compressibility factor. Analysis of non-flow and flow processes for an ideal gas under constant volume (Isochoric), constant pressure (isobaric), constant temperature (isothermal), adiabatic and polytropic conditions. Ideal Gas	12
	Mixtures, Dalton's and Amagat's laws, properties of ideal gas mixtures, air-water vapour mixtures and simple thermodynamic processes involving them; specific and relative humidities, dew point and wet bulb temperature, adiabatic saturation temperature, psychrometric chart.	
3	Thermodynamic Relations T-ds relations, Helmholtz and Gibbs functions, Gibbs relations, Maxwell relations, Joule-Thomson coefficient, coefficient of volume expansion, adiabatic and isothermal compressibility, Clapeyron and Clapeyron-Clausius equations. Thermodynamic and power Cycles Carnot vapor cycle, ideal Rankine cycle, Rankine reheat cycle, vapor-compression refrigeration cycle.	12
4	Thermodynamics of fluid flow; Study of different types of boilers; Brief idea of hydraulic power plants.	9

Text and Reference Books:

Text:

1. PK Nag, Engineering Thermodynamics, McGraw Hill

Reference:

1. Richardson, J.F., Peacock, D.G. Coulson & Richardson's Chemical Engineering- Volume 3ed., First Indian ed. Asian Books Pvt. Ltd. 1998
2. Levenspiel. O., Chemical Reaction Engineering, Wiley Eastern Ltd.

Course Outcome:

After completion of the course the students will be able to

CO1: State the basic concept of thermodynamic system.

CO2: Explain the laws of thermodynamics and their applications

CO3: Illustrate the properties of pure substances and real gases.

CO4: Analyze the different thermodynamic relations and their applications.

CO5: Evaluate the fundamentals of Thermodynamics of fluid flow.

CO6: Solve the issues related to boilers and hydraulic power plants.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
2	Surveying and Levelling	ES-AE 302	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks End

Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge of students in the area of surveying methods.
2. To illustrate the different methods of levelling.

Pre-requisite:

1. Physics
2. Mathematics

Unit	Contents	Hrs./Unit
1	Surveying: Introduction, classification and basic principles, Linear measurements. Chain surveying. Cross staff survey,	12
2	Compass survey. Planimeter, Errors in measurements, their Elimination and correction. Plane table surveying.	12
3	Levelling, Levelling difficulties and error in levelling, Contouring, Computation of area and volume.	12
4	Theodolite traversing. Introduction to setting of curves. Total station, Electronic Theodolite. Introduction to GPS survey	9

Text and Reference Books:

Text:

1. Kanetkar TP 1993. Surveying and Levelling. Pune Vidyarthi Griha, Prakashan, Pune.

Reference:

1. Punmia, BC 1987. Surveying (Vol. I). Laxmi Publications, New Delhi.
2. Arora, KR 1990. Surveying (Vol. I), Standard Book House, Delhi.

Course Outcome:

After completion of the course the students will be able to

CO1: Read the basic concept of surveying and levelling.

CO2: Discuss the methods of surveying and levelling.

CO3: Illustrate the Theodolite traversing and GPS survey.

CO4: Calculate the area and volume of any site.

CO5: Find errors and difficulties in levelling.

CO6: Design and develop a contour map of any site.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

**Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)**

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
3	Fluid Mechanics and Open Channel Hydraulics	PC-AE 301	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks End

Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge of students in the area of Fluid Mechanics.
2. To illustrate the theory and applications of Open Channel Hydraulics.

Pre-requisite:

1. Physics
2. Mathematics

Unit	Contents	Hrs./Unit
1	Properties of fluids: Ideal and real fluid. Pressure and its measurement, Pascal's law, pressure forces on plane and curved surfaces, centre of pressure, buoyancy, meta centre and meta centric height, condition of floatation and stability of submerged and floating bodies; Kinematics of fluid flow: Lagrangian and Eulerian description of fluid motion, continuity equation, pathlines, streak lines and stream lines, stream function, Velocity potential and flow net. Types of fluid flow, translation, rotation, circulation and vorticity, Vortex motion.	12
2	Dynamics of fluid flow, Bernoulli's theorem, venturimeter, orifice meter and nozzle, siphon; Laminar flow: Stress strain relationships, flow between infinite parallel plates both plates fixed, one plate moving, discharge, average velocity; Laminar and turbulent flow in pipes, general equation or head loss Darcy Equation, Moody's diagram, Minor and major hydraulic losses through Pipes and fittings, flow through network of pipes, hydraulic gradient and energy gradient;	14
3	Flow through orifices (Measurement of Discharge, Measurement of Time), Flow through Mouthpieces, Flow over Notches, Flow over weirs, Chezy's formula for loss of head in pipes, Flow through simple and compound pipes, Open channel design and hydraulics: Chezy's formula, Bazin's formula, Kutter's Manning's formula, Velocity and Pressure profiles in open channels.	12
4	Hydraulic jump; Dimensional analysis and similitude: Rayleigh's method and Buckingham's Pi theorem, types of similarities, dimensional analysis, dimensionless numbers. Introduction to fluid machinery.	7

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Text and Reference Books:

Text:

1. Bansal R.K. A text book of Fluid Mechanics and Hydraulic Machines. Laxmi publications.

Reference:

1. Arora K.R. Fluid Mechanics, Hydraulics and Hydraulic Machines. Standard Publishers Distributors.
2. Longo S., Tanda M.G., Chiapponi L. 2020. Problems in Hydraulics and Fluid Mechanics. Springer International Publishing.

Course Outcome:

After completion of the course the students will be able to

CO1: Read the basic concept of fluid mechanics.

CO2: Explain the dynamics and kinematics of fluid flow.

CO3: Establish stress-strain relationships.

CO4: Calculate the hydraulic losses.

CO5: Measure the flow through orifices and notches.

CO6: Design open channel for fluid flow.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
4	Agriculture for Engineers	PC-AE 302	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks End

Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge of students in the area of Agriculture.
2. To illustrate the basics of Horticulture.

Pre-requisite:

1. Biology
2. Chemistry

Unit	Contents	Hrs./Unit
1	Introduction and scope of agronomy. Classification of crops, Effect of different weather parameters on crop growth and development. Principles of tillage, tilling and its characteristics. Crop seasons. Methods, time and depth of sowing of major field crops. Methods and time of application of manure and fertilizers. Organic farming - Sustainable agriculture.	12
2	Soil-water-plant relationship, crop coefficients, water requirement of crops and critical stages for irrigation, weeds and their control, crop rotation, cropping systems, Relay cropping and mixed cropping.	12
3	Scope of horticulture. Soil and climatic requirements for fruits, vegetables and floriculture crops, Improved varieties, Criteria for site	12

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	selection, layout and planting methods, nursery raising, commercial varieties/hybrids, sowing and planting times and methods, seed rate and seed treatment for vegetable crops; macro and micro propagation methods, plant growing structures, pruning and training.	
4	Fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging, post harvest practices, Garden tools, management of orchard, Extraction and storage of vegetables seeds. Major pests and diseases and their management in horticulture crops.	9

Text and Reference Books:

Text:

1. Reddy Yellamanda T and Shankar Reddy GH. 1995. Principles of Agronomy. Kalyani Publishers.

Reference:

1. William L Donn. 1965. Meteorology. McGraw-Hill Book Co. New York.
2. Arnon L. 1972. Crop Production in Dry Regions. Leonard Hill Publishing Co. London.

Course Outcome:

After completion of the course the students will be able to

CO1: Identify the basics of agronomy and horticulture.

CO2: Explain the soil-water-plant relationship.

CO3: Illustrate the cropping pattern.

CO4: Analyze the major pest and diseases.

CO5: Assess the crop irrigation and fertilization method.

CO6: Plan and design a system for crop quality improvement.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
5	Professional Ethics & IPR	HM-AE 301	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge of professional ethics.
2. To illustrate the basics of IPR.

Pre-requisite:

1. English

Unit	Contents	Hrs./Unit
1	Morals, values and ethics-integrity-work ethic , moral dilemmas, Kohlberg's theory-gilligan's theory-consensus and controversy, models of professional roles-theories about right action, Moral leadership-code of conduct, introduction to techniques of professional excellence and stress management. corporate social responsibility, respect for authority, confidentiality-conflicts of interest, occupational crime-professional rights, employee rights Ethical issues in engineering practice, social and ethical responsibilities of technologists, Conflicts between business demands	12

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	and professional ideas, fair trade practices, case studies Environmental ethics , environmental regulations, Safety and risk-assessment, risk benefit analysis and mitigation of risk.	
2	Introduction to IPR: Meaning of property, Origin, Nature, Meaning of Intellectual Property Rights,. Kinds of Intellectual property rights— Copy Right, Patent, Trade Mark, Trade Secret and trade dress, Design, Layout Design, Geographical Indication, Plant Varieties and Traditional Knowledge	7
3	Patents and copyrights —Origin, Meaning of Patent, Types, Inventions which are not patentable, Registration Procedure, Rights and Duties of Patentee, Assignment and license, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties.	6
4	Copyright- Origin, Definition, types of Copy Right; Registration procedure, Assignment & license, Terms of Copy Right, Infringement, Remedies, Copyrights with special reference to food recipients, additives and processed products	6
5	Trademarks —Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks, Infringement & Remedies, Offences relating to Trade Marks, Passing Off, Penalties.	4
6	Design- Meaning, Definition, Object, Registration of Design, Cancellation of Registration, International convention of design-type and functions.	4
7	International registration systems , Provision of IPR under TRIPS and WTO, unfair competitions, Legal implications and public concerns in genetic modification in foods, International and National policies of food security.	6

Text and Reference Books:

1. Ajit Parulekar and Sarita D Souza, Indian Patents Law-Legal and Business Implications, Macmillan India Ltd, 2006
2. B.L. Wadehra, Law Relating to Patents, Trade Marks, Copyrights, Designs and Geographical Indications, Universal Law Publishing Pvt. Ltd., India 2000
3. P. Narayanan, Law of Copyright and Industrial Designs, Eastern Law House, Delhi, 2010
4. Intellectual Property Rights in Agricultural Biotechnology; Edited by Erbish, Maredia, CABI
5. T.M. Murray and M.J. Mehlam, Encyclopedia of Ethical, Legal and Policy issues in Biotechnology, John Wiley and Sons 2000
6. S.K. Chakraborty: Values and Ethics in Organization, OUP
7. N. Tripathi, Human values, Newage International Economic Reforms and Food Security. The Impact of trade and technology in South Asia by Suresh Chandra Babu, Haworth Press

Course Outcome:

After completion of the course the students will be able to

CO1: Identify moral and ethics in profession.

CO2: Relate informed critical reflection on the nature of professionalism and ethical challenges inherent in professionalism

CO3: Explain ethical concepts, challenges and dilemmas confronting members in various aspects of food industry

CO4: Analyze the significance of various types of IPR with special reference to food industry

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering

(Applicable from the academic session 2023-2024)

CO5: Assess the strategy of acquiring patent and copyright for own innovative works.

CO6: Test the plagiarized contents in written representations and innovations which can be questioned legally in works

Haldia Institute of Technology
(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)
Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)

Practical:

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Surveying and Levelling Lab	ES-AE 391	100	0	0	3	1.5

Practical: 3 hrs./week

Maximum Marks: 100 Marks

Continuous Internal Assessment: 40 Marks

External Assessment: 60 Marks

Distribution of Marks: Experiments – 40 Marks
Viva – 20 Marks

Objective:

- To solve the problems on chain and compass survey.
- To solve the problems on levelling.

Unit	Contents	No. of practicals
1	Chain survey of an area and preparation of map	2
2	Compass survey of an area and plotting of compass survey	2
3	Plane table surveying	2
4	Levelling. L section and X sections and its plotting	2
5	Contour survey of an area and preparation of contour map	2
6	Introduction of software in drawing contour	2
7	Theodolite surveying	2
8	Ranging by Theodolite	2
9	Height of object by using Theodolite	2
10	Setting out curves by Theodolite	2
11	Minor instruments	1
12	Use of total station	1
Total		22

Course Outcome:

After completion of the course the students will be able to

CO1: Read the basic concept of surveying and levelling.

CO2: Discuss the methods of surveying and leveling.

CO3: Illustrate the Theodolite traversing.

CO4: Calculate the area and volume of any site.

CO5: Find errors and difficulties in levelling.

CO6: Design and develop a contour map of any site

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
2	Fluid Mechanics Lab	PC-AE 391	100	0	0	3	1.5

Practical: 3 hrs./week

Maximum Marks: 100 Marks

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Continuous Internal Assessment: 40 Marks

External Assessment: 60 Marks

Distribution of Marks: Experiments – 40 Marks
Viva – 20 Marks

Objective:

1. To solve the problems on Fluid mechanics.
2. To solve the problems on open channel.

Unit	Contents	No. of practicals
1	Study of manometers and pressure gauges;	2
2	Verification of Bernoulli's theorem;	2
3	Determination of coefficient of discharge of venturi-meter and orifice meter;	2
4	Determination of coefficient of friction in pipeline	2
5	Determination of coefficient of discharge for rectangular and Triangular notch	2
6	Determination of coefficient of discharge, coefficient of velocity and Coefficient of contraction for flow through orifice;	2
7	Determination of coefficient of discharge for mouthpiece;	2
8	Measurement of force exerted by water jets on flat and hemispherical vanes;	2
9	Determination of meta-centric height	1
10	Determination of efficiency of hydraulic ram	2
11	Study of current meter;	1
12	Velocity distribution in open channels and determination of Manning's coefficient	2
Total		22

Course Outcome:

After completion of the course the students will be able to

CO1: Read the basic concept of fluid mechanics.

CO2: Explain the dynamics and kinematics of fluid flow.

CO3: Establish stress-strain relationships.

CO4: Calculate the hydraulic losses.

CO5: Measure the flow through orifices and notches.

CO6: Design open channel for fluid flow.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
3	Report Writing	SI-AE 381	100	0	2	0	2

Tutorial: 2 hrs./week

Maximum Marks: 100 Marks

Details of Syllabus

Technical report on any topic related to Agricultural Engineering will consist of:

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

1. A general overview of the topic.
2. Materials and Methods.
3. Results and Discussion.
4. Conclusion.

A seminar will be conducted after submission of the report.

Course Outcomes:

After completion of the course the students will be able to

CO1: Identify different components of agricultural engineering, skills and scientific techniques.

CO2: Review a particular domain in agricultural engineering fields.

CO3: Explain a specific topic related to that particular domain in agricultural engineering.

CO4: Analyze the existing materials and methods related to that specific topic.

CO5: Choose the best methodology for that specific topic.

CO6: Plan and design future work on that particular topic.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

**Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)****Curriculum Structure****SEMESTER-IV**

Theory							
Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Refrigeration & Air Conditioning	ES-AE 401	100	3	0	0	3
2	Soil Mechanics	PC-AE 401	100	3	0	0	3
3	Theory of Machine and Machine Design	PC-AE 402	100	3	0	0	3
4	Watershed Hydrology	PC-AE 403	100	3	0	0	3
5	Numerical Methods & Statistical Methods	BS-AE 401	100	3	0	0	3
6	Environmental Science	MC-AE 401	100	2	0	0	2
7	Modelling and simulation in agriculture	VAC-AE 401	100	3	0	0	0
Total Marks: 600			Total Credit: 17				
Practical							
1	Soil Mechanics Lab	PC-AE 491	100	0	0	3	1.5
2	Watershed Hydrology Lab	PC-AE 492	100	0	0	3	1.5
3	Numerical Methods & Statistical Methods Lab	BS-AE 491	100	0	0	2	1
Total Marks: 300			Total Credit: 4				
Total						21 (17+4)	

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Theory:

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
1	Refrigeration & Air Conditioning	ES-AE 401	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge of students in the area of Refrigeration.
2. To illustrate the theory of Air conditioning.

Pre-requisite:

1. Physics
2. Mathematics

Unit	Contents	Hrs./Unit
1	Principles of refrigeration, - units, terminology, production of flow temperatures, air refrigerators working on reverse Carnot cycle and Bell Coleman cycle. Vapour refrigeration-mechanism, P-V, P-S, P-H diagrams, vapour compression cycles, dry and wet compression, super cooling and sub cooling.	12
2	Vapour absorption refrigeration system. Common refrigerants and their properties. Design calculations for refrigeration system. Cold storage plants. Thermodynamic properties of moist air, perfect gas relationship for Approximate calculation, adiabatic saturation process, wet bulb temperature and its measurement, psychrometric chart and its use, elementary psychrometric process.	16
3	Air conditioning-principles-Type and functions of air conditioning, principles in air conditioning, air distribution and duct design methods,	10
4	Fundamentals of design of complete air conditioning systems-humidifiers and dehumidifiers-Cooling, calculations, types of air conditioners-applications.	7

Text and Reference Books:

Text:

1. Arora C P. 2021. Refrigeration and Air Conditioning. Tata McGraw Hill Publishing Co. Ltd.

Reference:

1. Khurmi RS. 1992. Engineering Thermodynamics. S Chand and Co. Ltd., Ram Nagar, New Delhi.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

2. Nag P K. 1995. Engineering Thermodynamics. Tata McGraw Hill Publishing Co. Ltd., 12/4 Asaf Ali Road, New Delhi.

Course Outcome:

After completion of the course the students will be able to

CO1: Understand the principle of refrigeration.

CO2: Explain the super cooling and sub cooling.

CO3: Develop the psychometric chart.

CO4: Analyze the air conditioning principles.

CO5: Assess the humidifiers and dehumidifiers.

CO6: Design the refrigeration system.

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
2	Soil Mechanics	PC-AE 401	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge of students in the area of Soil Mechanics.
2. To illustrate the theory and applications of shear strength, consolidation of soil and earth pressure.

Pre-requisite:

1. Physics
2. Mathematics

Unit	Contents	Hrs./Unit
1	Introduction of soil mechanics, field of soil mechanics, phase diagram, physical and index properties of soil, classification of soils, effective and neutral stress, elementary concept of Boussinesq and Westergaard's analysis, newmark influence chart. Seepage Analysis; Quick condition-two dimensional flow- Laplace equation, Velocity potential and stream function, Flow-net construction.	11
2	Shear strength, Mohr stress circle, and theoretical relationship between principal stress circle, theoretical relationship between Principal stress, Mohr coulomb failure theory, and effective stress principle. Determination of shear parameters By direct shear test, triangle test & vane shear test. Numerical exercise based on various types of tests. Compaction, composition of soils standard and modified proctor test, abbot compaction and Jodhpur Mini compaction test field compaction method and control.	14
3	Consolidation of soil: Consolidation of soils, one dimensional consolidation spring analogy, Terzaghi's theory, Laboratory consolidation test, calculation of void ratio and coefficient of volume change, Taylor's and Casagrande's method, determination of coefficient of consolidation. Earth pressure: plastic equilibrium in soils, active and passive states,	14
4	Rankine's theory of earth pressure, active and passive earth pressure	6

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	for cohesive soils, simple numerical exercises. Stability of slopes: introduction to stability analysis of infinite and finite slopes friction circle method, Taylor's stability number.	
--	--	--

Text and Reference Books:

Text:

1. Punmia B C, Jain A K and Jain A K. 2005. Soil Mechanics and Foundations. Laxmi Publications (P) Ltd. New Delhi.

Reference:

1. Ranjan Gopal and Rao ASR. 1993. Basic and Applied Soil Mechanics. Welley Easters Ltd., New Delhi.

Course Outcome:

After completion of the course the students will be able to

CO1: Understand the basic concept of soil mechanics.

CO2: Explain the flow-net construction.

CO3: Solve the shear strength.

CO4: Analyze the consolidation of soil.

CO5: Assess the earth pressure.

CO6: Test the stability of slopes.

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
3	Theory of Machine and Machine Design	PC-AE 402	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge in Theory of machine.
2. To illustrate the theory of Machine design.

Pre-requisite:

1. Physics
2. Mechanics
3. Mathematics

Unit	Contents	Hrs./Unit
1	Elements, links, pairs, kinematics chain, and mechanisms. Classification of pairs and mechanisms. Lower and higher pairs. Four bar chain, slider crank chain and their inversions. Determination of velocity and acceleration using graphical (relative velocity and acceleration) method. Instantaneous centers. Types of gears. Law of gearing, velocity of sliding between two teeth in mesh. Involute and cycloidal profile for gear	14

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	teeth. Spur gear, nomenclature, interference and undercutting. Introduction to helical, spiral, bevel and worm gear. Simple, compound, reverted, and epicyclic trains. Determining velocity ratio by tabular method. Turning moment diagrams, coefficient of fluctuation of speed and energy, weight of flywheel, flywheel applications.	
2	Belt drives, types of drives, belt materials. Length of belt, power transmitted, velocity ratio, belt size for flat and V belts. Effect of centrifugal tension, creep and slip on power transmission, Chain drives. Types of friction, laws of dry friction. Friction of pivots and collars. Single disc, multiple disc, and cone clutches. Rolling friction, anti friction bearings. Types of governors. Constructional details and analysis of Watt, Porter, Proell governors. Effect of friction, controlling force curves. Sensitiveness, stability, hunting, iso-chronism, power and effort of a governor. Static and dynamic balancing. Balancing of rotating masses in one and different planes.	12
3	Meaning of design, Phases of design, design considerations. Common engineering materials and their mechanical properties. Types of loads and stresses, theories of failure, factor of safety, selection of allowable stress. Stress concentration. Elementary fatigue and creep aspects. Cotter joints, knuckle joint and pinned joints, turnbuckle. Design of riveted joints. Design of welded subjected to static loads. Design of threaded fasteners subjected to direct static loads, bolted joints loaded in shear and bolted joints subjected to eccentric loading.	11
4	Design of shafts under torsion and combined bending and torsion. Design of keys. Design of muff, sleeve, and rigid flange couplings. Design of helical and leaf springs. Design of flat belt and V-belt drives and pulleys. Design of gears. Design of screw motion mechanisms like screw jack, lead screw, etc. Selection of anti-friction bearings.	8

Text and Reference books:

Text:

1. Khurmi R S and Gupta J K. 1994. Theory of Machines. Eurasia Publishing House Pvt. Ltd., Ram Nagar, New Delhi.
2. Khurmi R S and Gupta J K. 2014. A Text Book of Machine Design. S. Chand & Company Ltd., New Delhi.

Reference:

1. Bevan Thomas. 1984. Theory of Machines. CBS Publishers and Distributors, Delhi.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

- Ballaney P L. 1985. Theory of Machines. Khanna Publishers, 2-B Nath Market, Nai Sarak, New Delhi.
- Rao J S and Dukkipatti R V. 1990. Mechanisms and Machine Theory. Wiley astern Ltd., New Delhi.
- Lal Jagdish. 1991. Theory of Mechanisms and Machines. Metropolitan Book Co. Pvt.Ltd., 1 Netaji Subash Marg, New Delhi..
- Rattan S B. 1993. Theory of Machines. Tata McGraw Hill Publishing Co. Ltd., 12/4 Asaf Ali Road, New Delhi.
- Jain R K. 2013. Machine Design. Khanna Publishers, 2-B Nath Market, Nai Sarak, New Delhi.

Course Outcome:

After completion of the course the students will be able to

CO1: Understand the basic concept of gear.

CO2: Explain the belt drive.

CO3: Identify the function of governors.

CO4: Analyze the balancing of rotating masses.

CO5: Assess loads and stresses.

CO6: Test the design of shafts and keys.

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
4	Watershed Hydrology	PC-AE 403	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

- To develop the fundamental knowledge of hydrologic cycle.
- To illustrate the hydrograph and flood routing.

Pre-requisite:

- Physics
- Mathematics

Unit	Contents	Hrs./Unit
1	Hydrologic cycle, precipitation and its forms, rainfall measurement and estimation of mean rainfall, frequency analysis of point rainfall. Mass curve, hyetograph, depth-area-duration curves and intensity-duration-frequency relationship. Hydrologic processes- Interception, infiltration -factors influencing, measurement and indices. Evaporation – Estimation and measurement.	14
2	Runoff - Factors affecting, measurement, stage - discharge rating curve, estimation of peak runoff rate and volume, Rational method, Cook's method and SCS curve number method. Geomorphology of watersheds – Linear, aerial and relief aspects	12

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	of watersheds- stream order, drainage density and stream frequency.	
3	Hydrograph - Components, base flow separation, unit hydrograph theory, S-curve, synthetic hydrograph, applications and limitations. Stream gauging - discharge rating curves, flood peak, design flood and computation of probable flood.	12
4	Flood routing – channel and reservoir routing. Drought – classification causes and impacts, drought management strategy.	7

Text and reference books:

Text:

1. Subramanya, K. 2008. Engineering Hydrology. 3rd Edition, Tata McGraw-Hill Publishing Co., New Delhi.
2. Suresh, R. 2005. Watershed Hydrology. Standard Publishers Distributors, Delhi.
3. Jaya Rami Reddy, P. 2011. A Text Book of Hydrology. University Science Press, New Delhi.

Reference:

1. Chow, V.T., D.R. Maidment and L.W. Mays. 2010. Applied Hydrology, McGraw Hill Publishing Co., New York.
2. Linsley, R.K., M.A. Kohler, and J.L.H. Paulhus. 1984. Hydrology for Engineers. McGraw-Hill Publishing Co., Japan.
3. Mutreja, K.N. 1990. Applied Hydrology. Tata McGraw-Hill Publishing Co., New Delhi.
4. Raghunath, H.M. 2006. Hydrology: Principles Analysis and Design. Revised 2nd Edition, New Age International (P) Limited Publishers, New Delhi.
5. Varshney, R.S. 1986. Engineering Hydrology. Nem Chand and Brothers, Roorkee, U.P.

Course Outcome:

After completion of the course the students will be able to

CO1: Understand the hydrologic cycle.

CO2: Explain the hydrologic processes.

CO3: Solve the runoff estimation methods.

CO4: Examine the hydrograph components.

CO5: Evaluate the flood routing.

CO6: Plan the drought management strategy.

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
5	Numerical Methods & Statistical Methods	BS-AE 401	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge of numerical methods.
2. To illustrate the statistical methods.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Pre-requisite:

1. Mathematics

Unit	Contents	Hrs./Unit
1	Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.	6
2	Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.	4
3	Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.	3
4	Design of experiments: Guidelines for designing experiments and importance of designed experiments in food research, Types of DOE: Full Factorial, fractional factorial, central composite design, rotatable central composite experimental design, box behenken design. Limitations of each.	8
5	Analysis of variance of experiments with one or more fixed and random factors, Multiple comparisons. Analysis of residuals, Non-parametric ANOVA, Kruskal-Wallis test.	6
6	Developing empirical equations using experimental data; Basics of RSM (Response surface methodology)	4
7	Application of Fuzzy logic to sensory evaluation and ranking of agricultural products.	3
8	Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.	4
9	Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	3
10	Testing of fitness: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes	4

Text and Reference Books:

Text:

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

5. Experimental Designs, 2nd Edition, William G. Cochran, Gertrude M. Cox, ISBN: 978-0-471-54567-5 May 1992
6. Montgomery, D.C. (2009). Design and Analysis of Experiments.

References:

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.

Course Outcome:

After completion of the course the students will be able to

CO1: Understand the interpolation.

CO2: Explain the numerical integration.

CO3: Plan the design of experiments.

CO4: Analyze the fuzzy logic.

CO5: Evaluate the applied statistics.

CO6: Solve the test of significance.

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
6	Environmental Science	MC-AE 401	100	3	0	0	0

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge of environmental science.
2. To illustrate the air, water, land and noise pollution.

Pre-requisite:

1. Biology for engineers

Unit	Contents	Hrs./Unit
1	Introduction: Basic ideas of environment, basic concepts, man, society & environment, their interrelationship. Environmental Laws of India. Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-a-vis population growth, sustainable development.	7
2	Materials balance: Steady state conservation system, steady state system with non conservative pollutants, step function.	6

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	<p>Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of environmental science and engineering.</p>	
3	<p>Ecology: Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundarban); Food chain: definition and one example of each food chain, Food web. Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threat to biodiversity, Conservation of biodiversity.</p>	8
4	<p>Air pollution and control: Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems. Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on seawater level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget. Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).</p>	6
5	<p>Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC,</p>	6

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	<p>destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification.</p> <p>Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP, cyclone separator, bag house, catalytic converter, Ventury scrubber).</p>	
6	<p>Water Pollution and Control: Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds.</p> <p>Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic</p> <p>River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH.</p> <p>Lake: Eutrophication [Definition, source and effect].</p> <p>Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)</p> <p>Standard and control: Waste water standard [BOD, COD, Oil, Grease]</p> <p>Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds]; Tertiary treatment definition.</p>	4
7	<p>Land Pollution: Lithosphere; Internal structure of earth, rock and soil. Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).</p>	4
8	<p>Noise Pollution: Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L_{10} (18hr Index), L_{dn}. Noise pollution control.</p>	4

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	Environmental Management: Environmental impact assessment, Environmental audit, Environmental laws and protection act of India, Different International environmental treaty/ agreement/ protocol.	
--	--	--

Text and Reference Books:

Text:

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.

Reference:

1. De, A. K., "Environmental Chemistry", New Age International.

Course Outcome:

After completion of the course the students will be able to

CO1: Understand the basic idea of environment.

CO2: Explain the environmental law of India.

CO3: Solve the material balance.

CO4: Analyze the air, water, land and noise pollution.

CO5: Assess the environmental audit.

CO6: Propose the air, water, land and noise pollution control measures.

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
7	Modelling and simulation in agriculture	VAC-AE 001	100	3	0	0	0

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge of agricultural modelling.
2. To illustrate the application of agricultural modelling.

Pre-requisite:

1. Mathematics
2. Physics

Unit	Contents	Hrs./Unit
1	Brief introduction on watershed processes, importance of modelling and simulation of watershed processes; Introduction and installation of APSIM model and overview of data requirements; Simulation through APSIM model (calibration);	16
2	Introduction and installation of SPAW model	12

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	and overview of data requirements; Simulation through SPAW model (calibration); Practice class for simulation with APSIM and SPAW.	
3	DSS-ET model: Introduction and overview; Installation, Simulation with DSS-ET model.	9
4	Practice class for simulation with APSIM, SPAW and DSS-ET. Case studies with different models.	8

Course Outcome:

After completion of the course the students will be able to

CO1: Define climate data.

CO2: Explain soil data.

CO3: Experiment with soil, climate and water data.

CO4: Analyze crop water consumption.

CO5: Evaluate crop yield.

CO6: Test model performance.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Practical:

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
1	Soil Mechanics Lab	PC-AE 491	100	0	0	3	1.5

Objective:

1. To solve the problems on permeability of soil.
2. To perform grain size analysis by different methods.

Unit	Contents	No. of practicals
1	Determination of water content of soil. (Various methods)	3
2	Determination of specific gravity of soil	2
3	Grain size analysis by sieving (Dry sieve analysis)	2
4	Grain size analysis by hydrometer method	3
5	Determination of liquid limit by Casagrande's method	2
6	Determination of permeability by constant head method	2
7	Determination of permeability by variable head method	2
8	Determination of shear parameters by direct shear test	2
9	Determination of consolidation properties of soils	2
10	Determination of shear parameters by Tri-axial test	2
Total		22

Text and Reference Books:

Text:

1. Punmia B C, Jain A K and Jain A K. 2005. Soil Mechanics and Foundations. Laxmi Publications (P) Ltd. New Delhi.

Reference:

1. Ranjan Gopal and Rao ASR. 1993. Basic and Applied Soil Mechanics. Welley Easters Ltd., New Delhi.

Course Outcome:

After completion of the course the students will be able to

CO1: Recall the specific gravity and water content of soil.

CO2: Explain sieve analysis.

CO3: Solve the liquid limit.

CO4: Analyze the permeability of soil by various methods.

CO5: Assess the consolidation properties of soils.

CO6: Test the shear parameters by tri-axial test.

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
2	Hydrology Lab	PC-AE 492	100	0	0	3	1.5

Objective:

1. To solve the problems on different components of hydrological cycle.
2. To perform exercise on different types of hydrograph.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Unit	Contents	No. of practicals
1	Visit to meteorological observatory and study of different instruments. Design of rain gauge network. Exercise on intensity - frequency - duration curves. Exercise on depth - area - duration and double mass curves.	6
2	Analysis of rainfall data and estimation of mean rainfall by different methods. Exercise on frequency analysis of hydrologic data and estimation of missing data, test for consistency of rainfall records. Exercise on computation of infiltration indices.	6
3	Computation of peak runoff and runoff volume by Cook's method and rational formula. Computation of runoff volume by SCS curve number method. Study of stream gauging instruments - current meter and stage level recorder.	6
4	Exercise on geomorphic parameters of watersheds. Exercise on runoff hydrograph. Exercise on unit hydrograph. Exercise on synthetic hydrograph. Exercise on flood routing.	4
Total		22

Text and reference books:

Text:

4. Subramanya, K. 2008. Engineering Hydrology. 3rd Edition, Tata McGraw-Hill Publishing Co., New Delhi.
5. Suresh, R. 2005. Watershed Hydrology. Standard Publishers Distributors, Delhi.
1. Jaya Rami Reddy, P. 2011. A Text Book of Hydrology. University Science Press, New Delhi.

Reference:

1. Chow, V.T., D.R. Maidment and L.W. Mays. 2010. Applied Hydrology, McGraw Hill Publishing Co., New York.
2. Linsley, R.K., M.A. Kohler, and J.L.H. Paulhus. 1984. Hydrology for Engineers. McGraw-Hill Publishing Co., Japan.
3. Mutreja, K.N. 1990. Applied Hydrology. Tata McGraw-Hill Publishing Co., New Delhi.
4. Raghunath, H.M. 2006. Hydrology: Principles Analysis and Design. Revised 2nd Edition, New Age International (P) Limited Publishers, New Delhi.
5. Varshney, R.S. 1986. Engineering Hydrology. Nem Chand and Brothers, Roorkee, U.P.

Course Outcome:

After completion of the course the students will be able to

CO1: Define hydrological data.

CO2: Explain double mass curve.

CO3: Solve the infiltration indices.

CO4: Analyze the peak runoff rate.

CO5: Evaluate unit hydrograph.

CO6: Test the flood routing.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
3	Numerical Methods & Statistical Methods Lab	BS-AE 491	100	0	0	2	1

Objective:

1. To solve the problems on different numerical methods.
2. To perform exercise on regression analysis.

Unit	Contents	No. of practicals
1	Assignments on Newton forward /backward, Lagrange's interpolation	1
2	Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule	2
3	Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations	1
4	Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.	2
5	Assignments on ordinary differential equation: Euler's and Runge-Kutta methods.	2
6	Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica	1
7	Generate Various types of DOE using Minitab,/Design Expert,	1
8	Perform regression analysis using Minitab,/Design Expert /SPSS	2
9	Construct graphical displays of science/engineering data and interpret the role of such displays in data analysis.	1
10	Assignment on performing ANOVA for a given data	1
11	Perform sensory evaluation for a agricultural product using fuzzy logic	1
Total		15

Text and Reference Books:

Text:

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).
5. Experimental Designs, 2nd Edition, William G. Cochran, Gertrude M. Cox, ISBN: 978-0- 471-54567-5 May 1992
6. Montgomery, D.C. (2009). Design and Analysis of Experiments.

References:

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Course Outcome:

After completion of the course the students will be able to

CO1: Define Newton forward /backward.

CO2: Explain numerical integration by Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.

CO3: Solve the Algebraic Equation by Regular-falsi and Newton Raphson methods.

CO4: Analyze regression analysis using Minitab, /Design Expert /SPSS.

CO5: Assess graphical displays of science/engineering data.

CO6: Test sensory evaluation using fuzzy logic

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

**Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)****Curriculum Structure****SEMESTER-V**

Theory							
Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
1	Farm Machinery & Equipment	PC-AE 501	100	3	0	0	3
2	Irrigation & Drainage Engineering	PC-AE 502	100	3	0	0	3
3	Post Harvest Engineering	PC-AE 503	100	3	0	0	3
4	Heat and Mass Transfer	PC-AE 504	100	3	0	0	3
5	Professional Elective – I (Crop production/Plastic application in agriculture/Seed technology and processing)	PE-AE 501 (A/B/C)	100	3	0	0	3
6	Open Elective – I (Fundamentals of Renewable Energy Sources/Bio-energy Systems: Design and Applications/ Building Construction and Cost Estimation)	OE-AE 501 (A/B/C)	100	3	0	0	3
7	Agriculture Economics	HM-AE 501	100	3	0	0	3
Total Marks: 700		Total Credit: 21					
Practical & Sessional							
1	Farm Machinery Lab	PC-AE 591	100	0	0	3	1.5
2	Irrigation & Drainage Engineering Lab	PC-AE 592	100	0	0	3	1.5
3	Post Harvest Engineering Lab	PC-AE 593	100	0	0	2	1
4	NSS		100	0	0	3	0
Total Marks: 300		Total Credit: 4					
Total Credit						25 (21+4)	

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Theory:

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
1	Farm Machinery & Equipment	PC-AE 501	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

3. To develop the fundamental knowledge of farm implements and machineries.
4. To illustrate the working principles of sowing, planting, weeding and harvesting equipments.

Pre-requisite:

2. Mathematics
3. Physics
4. Theory of machines

Unit	Contents	Hrs./Unit
1	Introduction to farm mechanization. Introduction to machines used for primary tillage, secondary tillage, rotary tillage, deep tillage and minimum tillage. Identification and selection of machines for various operations on the farm. Hitching systems and controls of farm machinery. Calculation of field capacities and field efficiency. Measurement of draft of tillage tools and calculations for power requirement for the Tillage machines. Introduction to seed-bed preparation and its classification. Familiarization with land reclamation and earth moving equipment.	14
2	Introduction to mechanism of different agricultural machinery like mould-board plough, disc plough, chisel plough, sub-soiler, harrows, cultivators. Introduction to plant protection equipment – sprayers and dusters. Introduction to inter-cultural equipment. Familiarization of fertilizer application equipment. Study of harvesting machinery and operation. Introduction to sowing, planting & transplanting equipment. Introduction to seed drills, no-till drills, and strip-till drills.	14
3	Study of shear type harvesting devices – cutter bar, inertial forces, counter balancing, terminology, cutting pattern. Study of reapers, binders and windrowers – principle	12

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	of operation and constructional details. Study of types of furrow openers and metering systems in drills and planters. Calibration of seed-drills/ planters. Types of threshing machinery and their applications. Weed control and plant protection equipment like sprayer, duster and their calibration and selection, constructional features of different components and adjustments during operation.	
4	Study of advanced agricultural machinery and their functional components like combine harvester, Cotton harvesting etc. Introduction to vegetables and fruit harvesting equipment and tools. Study of chaff cutters and capacity calculations. Study of root crop diggers – principle of operation. Cost of operation of farm machinery.	5

Text and reference books:

Text:

1. Kepner RA, Roy Barger & EL Barger. Principles of Farm Machinery.
2. Lal Radhey and AC Datta. Agricultural Engineering.
3. Dr. Jagadishwar Sahay. Elements of Agricultural Engineering.

Reference:

1. Smith HP and LH Wilkey. Farm Machinery and Equipment.
2. Srivastava AC. Elements of Farm Machinery.

Course Outcome:

After completion of the course the students will be able to

- CO1:** Describe the concept of farm mechanization.
CO2: Understand the mechanism of primary and secondary agricultural machinery.
CO3: Illustrate the working principle of harvesting, sowing and planting machinery.
CO4: Explain the concept of plant protection and threshing equipment.
CO5: Evaluate the cost of agricultural machinery.
CO6: Plan and design advance agricultural machinery.

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
2	Irrigation & Drainage Engineering	PC-AE 502	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge of various Irrigation methods.
2. To design the channels needed for irrigation purpose.
3. To design the surface and subsurface drainage system.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Pre-requisite:

1. Mathematics
2. Fluid Mechanics
3. Soil Mechanics
4. Engineering Hydrology

Unit	Contents	Hrs./Unit
1	Major and medium irrigation schemes of India, purpose of irrigation, environmental impact of irrigation projects, source of irrigation water, present status of development and utilization of different water resources of the country; measurement of irrigation water: weir, flumes and orifices and other methods; open channel water conveyance system : design and lining of irrigation field channels, on farm structures for water conveyance, control & distribution; underground pipe conveyance system: components and design; land grading: criteria for land levelling, land levelling design methods, estimation of earth work.	15
2	Soil water plant relationship: soil properties influencing irrigation management, soil water movement, infiltration, soil water potential, soil moisture characteristics, soil moisture constants, measurement of soil moisture, moisture stress and plant response; water requirement of crops: concept of evapotranspiration (ET), measurement and estimation of ET, water and irrigation requirement of crops, depth of irrigation, frequency of irrigation, irrigation efficiencies; surface methods of water application: border, check basin and furrow irrigation- adaptability, specification and design considerations.	14
3	Water logging- causes and impacts; drainage, objectives of drainage, familiarization with the drainage problems of the state; surface drainage coefficient, types of surface drainage, design of surface drains; sub-surface drainage: purpose and benefits, investigations of design parameters-hydraulic conductivity, drainable porosity, water table; derivation of Hooghoudt's and Ernst's drain spacing equations.	9
4	Design of subsurface drainage system; drainage materials, drainage pipes, drain envelope; layout, construction and installation of drains; drainage structures; vertical drainage; bio-drainage; mole drains;	7

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	salt balance, reclamation of saline and alkaline soils, leaching requirements, conjunctive use of fresh and saline water.	
--	---	--

Suggested Reading

- Bhattacharya A K and Michael A M. 2013. Land Drainage, Principles, Methods and Applications. Vikas Publication House, Noida (UP)
- Ritzema H.P. 1994 Drainage Principles and Applications, ILRI Publication 16, Second Edition (Completely Revised)
- Michael A.M. and Ojha T.P. 2014. Principles of Agricultural Engineering Vol-II 5th Edition. Jain Brothers Publication, New Delhi
- Kadam U.S., Thokal R.T., Gorantiwar S.D. and Powar A.G. 2007. Agricultural Drainage-Principles and Practices, Westville Publishing House
- FAO Irrigation and Drainage Paper No. 6, 9, 15, 16, 28 and 38. Rome, Italy.
- Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing House New Delhi.
- Majumdar D. K. 2013. Irrigation Water Management Principles. PHI learning Private Limited New Delhi 2nd Edition.
- Allen R. G., L. S. Pereira, D. Raes, M. Smith. 1998. Crop Evapotranspiration guidelines for computing crop water requirement. Irrigation and drainage Paper 56, FAO of United Nations, Rome.
- Murthy V.V.N. 2013. Land and Water Management Engineering. Kalyani Publishers, New Delhi.
- Israelsen O W. and Hansen V. E and Stringham G. E. 1980. Irrigation Principles and Practice, John Wiley & Sons, Inc. USA.

Course Outcomes:

After completion of the course the students will be able to

CO1: Define irrigation and drainage

CO2: Understand the basics of irrigation and drainage system

CO3: Explain different structures for irrigation and drainage purpose

CO4: Analyze different design parameters for irrigation and drainage system

CO5: Determine crop irrigation requirement and drainage spacing

CO6: Plan and design an advance irrigation and drainage system

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
3	Post Harvest Engineering	PC-AE 503	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge of post harvest operations.
2. To explain the different post harvest equipments.

Pre-requisite:

1. Mathematics
2. Physics
3. Refrigeration and Air conditioning

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

**Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)**

Unit	Contents	Hrs./Unit
1	<p>Cleaning and grading, aspiration, scalping; size separators, screens, sieve analysis, capacity and effectiveness of screens. Various types of separators: specific gravity, Magnetic, disc, spiral, pneumatic, inclined draper, velvet roll, colour sorters, cyclone, shape graders.</p> <p>Size reduction: principle, Bond's law, Kick's law, Rittinger's law, procedure (crushing, impact, cutting and shearing), Size reduction machinery: Jaw crusher, Hammer mill, Plate mill, Ball mill.</p> <p>Scope & importance of material handling devices, study of different types of material handling systems; belt, chain and screw conveyor, bucket elevator, pneumatic conveying, gravity conveyor- design consideration, capacity and power requirement.</p>	14
2	<p>Elevators: bucket, Cranes & hoists. Pneumatic conveying. Drying: moisture content and water activity; Free, bound and equilibrium moisture content, isotherm, hysteresis effect, EMC determination, Psychrometric chart and its use in drying, Drying principles and theory, Thin layer and deep bed drying analysis, Falling rate and constant rate drying periods, maximum and decreasing drying rate period, drying equations, Mass and energy balance, Shedd's equation, Dryer performance, Different methods of drying, batch-continuous; mixing-non-mixing, Sun-mechanical, conduction, convection, radiation, superheated steam, tempering during drying, Different types of grain dryers: bin, flat bed, LSU, columnar, RPEC, fluidized, rotary and tray. Theory of filtration, study of different types of filters, rate of filtration, pressure drop during filtration.</p>	14
3	<p>Mixing: Theory of mixing of solids and pastes, Mixing index, types of mixers for solids, liquid foods and pastes. Milling of rice: Conditioning and parboiling, advantages and disadvantages, traditional methods, CFTRI and Jadavpur methods, Pressure parboiling method, Types of rice mills, Modern rice milling, different unit operations and equipment. Milling of wheat, unit operations and equipment. Milling of pulses: traditional milling methods, commercial methods, preconditioning, dry milling and</p>	12

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	wet milling methods: CFTRI and Pantnagar methods. Pulse milling machines, Milling of corn and its products. Dry and wet milling. Milling of oilseeds: mechanical expression, screw press, hydraulic press, solvent extraction methods, preconditioning of oilseeds, refining of oil, stabilization of rice bran., Extrusion cooking: principle, factors affecting, single and twin screw extruders. By-products utilization.	
4	Design consideration for grain storage godowns, cold storage, bag storage structures, silos, shallow and deep bin, Calculation of pressure in bins, storage of seeds.	5

Text and reference books:

Text:

1. Chakraverty, A. Post Harvest Technology of cereals, pulses and oilseeds. Oxford & IBH publishing Co. Ltd., New Delhi.
2. Dash, S.K., Bebartta, J.P. and Kar, A. Rice Processing and Allied Operations. Kalyani Publishers, New Delhi.
3. Sahay, K.M. and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas Publishing house Pvt. Ltd. New Delhi.
4. Geankoplis C. J. Transport processes and unit operations, Prentice Hall of India Pvt Ltd, New Delhi

Reference:

1. Earle, R.L. 2003. Unit Operations in Food Processing. Pergamon Press. Oxford. U.K.
2. Henderson, S.M., and Perry, R. L. Agricultural Process Engineering, Chapman and hall, London
3. McCabe, W.L., Smith J.C. and Harriott, P. Unit operations of Chemical Engineering. McGraw Hill.
4. Singh, R. Paul. And Heldman, R.Dennis. 2004. Introduction to Food Engineering. 3rd Edition. Academic Press, London.

Course Outcome:

After completion of the course the students will be able to

CO1: Define and describe the basics of cleaning and grading.

CO2: Classify and discuss about conveyer and dryer.

CO3: Calculate milling and the theory of mixing of food.

CO4: Compare and differentiate dry and wet milling of oilseeds.

CO5: Estimate and evaluate scope & importance of material handling devices.

CO6: Design storage structures

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
4	Heat and Mass Transfer	PC-AE 504	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Objective:

1. To understand the fundamental principles governing the transfer of heat and mass in various engineering and natural systems.
2. To apply the knowledge of heat and mass transfer to analyse and design thermal systems, chemical processes, and environmental phenomena.

Pre-requisite:

1. Physics
2. Mathematics
3. Chemistry

Unit	Contents	Hrs./Unit
1	Concept, modes of heat transfer, thermal conductivity of materials, measurement. General differential equation of conduction. One dimensional steady state conduction through plane and composite walls, tubes and spheres with and without heat generation. Electrical analogy. Insulation materials. Fins, Free and forced convection. Newton's law of cooling, heat transfer coefficient in convection.	12
2	Dimensional analysis of free and forced convection. Useful non dimensional numbers. Equation of laminar boundary layer on flat plate and in a tube. Laminar forced convection on a flat plate and in a tube. Combined free and forced convection. Introduction. Absorptivity, reflectivity and transmissivity of radiation. Black body and monochromatic radiation.	12
3	Planck's law, Stefan-Boltzman law, Kirchoff's law, grey bodies and emissive power, solid angle, intensity of radiation. Radiation exchange between black surfaces, geometric configuration factor. Heat transfer analysis involving conduction, convection and radiation by networks.	11
4	Types of heat exchangers, fouling factor, log-mean temperature difference, heat exchanger performance, transfer units. Heat exchanger analysis restricted to parallel and counter flow heat exchangers. Steady state molecular diffusion in fluids at rest and in laminar flow, Flick's law, mass transfer coefficients. Reynold's analogy.	10

Suggested Reading

- Geankoplis C.J. 1978. Transport Port Processes and Unit Operations. Allyn and Bacon Inc., Newton, Massachusetts.
- Holman J P. 1989. Heat Transfer. McGraw Hill Book Co., New Delhi.
- Incropera F P and De Witt D P. 1980. Fundamentals of Heat and Mass Transfer. John Wiley and Sons, New York.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Gupta C P and Prakash R. 1994. Engineering Heat Transfer. Nem Chand and Bros., Roorkee.

Course Outcome:

After completion of the course the students will be able to

CO1: Define and identify the basics of heat and mass transfer.

CO2: Classify and explain heat and mass transfer to predict transfer coefficients.

CO3: Compare and examine working of various heat transfer equipment.

CO4: Analyse and categorise different heat and mass transfer equipment.

CO5: Test and evaluate various types of heat exchangers.

CO6: Develop and justify model on the principles of mass transfer.

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
5	Professional Elective – I (Crop Production)	PE-AE 501 (A)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To establish the basic knowledge of crop types and cultivation practices.
2. To get familiarize with the processing of crops after harvesting.

Pre-requisite:

1. Biology
2. Agriculture for Engineers

Unit	Contents	Hrs./Unit
1	Study of the area and production of cereals and pulses in the World, Study of the cultivation practices, varieties, seed bed preparation, sowing and seed treatment, sowing time, seed rate, spacing, application of manures and fertilisers, bio fertilisers with case study.	14
2	Irrigation, intercultural weed control, insect and disease control, harvesting, threshing, winnowing, cleaning, drying and grading, storage marketing and quality consideration of the following crops:- Rice, wheat, maize, small millets, Green gram, black gram, lentil, Bengal gram, pigeon pea, pea, cow pea, French bean with case study.	14
3	Study of the area and production of oilseed, fibre crops, cash crops, spices and aromatic crops in India. Study of the cultivation practices, varieties, seed bed preparation, sowing and seed treatment, sowing time, seed	11

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	rate, and spacing with case study.	
4	Intercultural operations, weed control, insect and disease control, harvesting, processing, grading and marketing and quality consideration of the mentioned crops with case study.	6

Suggested Reading

Michael AM, Khepar SD. and SK Sondhi. 2008. Water Well and Pumps, 2nd Edition, Tata Mc-Graw Hill.
Todd David Keith and Larry W. Mays. 2004. Groundwater Hydrology, 3rd Edition, John Wiley & Sons, New York (International Book Distributing Company Lucknow).

Michael AM. and Ojha TP. 2014. Principles of Agricultural Engineering Vol-II, 5th Edition. Jain Brothers Publication, New Delhi.

Course outcome:

After completion of the course the students will be able to

CO1: Identify different varieties of crops according to their family.

CO2: Describe different kinds of cultivation practices.

CO3: Illustrate the suitable application of manures and fertilisers.

CO4: Categorise machines needed for post harvest operations.

CO5: Choose precautionary management for weed and pest control.

CO6: Generalise the skill of marketing and quality improvement of the crops.

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
5	Professional Elective – I (Plastic application in Agriculture)	PE-AE 501 (B)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge of Plasticulture.
2. To get familiarize with application of plastic materials in different domains of Agriculture.

Pre-requisite:

1. Chemistry
2. Agriculture for Engineers

Unit	Contents	Hrs./Unit
1	Introduction of plasticulture- types and quality of plastics used in soil and water conservation, production agriculture and post harvest management. Quality control measures. Present status and future prospective of plasticulture in India. Water management- use of plastics in in-situ	14

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	moisture conservation and rain water harvesting. Plastic film lining in canal, pond and reservoir. Plastic pipes for irrigation water management, bore-well casing and subsurface drainage. Drip and sprinkler irrigation systems.	
2	Use of polymers in control of percolation losses in fields. Soil conditioning- soil solarisation, effects of different colour plastic mulching in surface covered cultivation. Nursery management- Use of plastics in nursery raising, nursery bags, trays etc. Controlled environmental cultivation- plastics as cladding material, green / poly / shade net houses, wind breaks, poly tunnels and crop covers.	12
3	Plastic nets for crop protection- anti insect nets, bird protection nets. Plastic fencing. Plastics in drying, preservation, handling and storage of agricultural produce, innovative plastic packaging solutions for processed food products. Plastic cap covers for storage of food grains in open. Use of plastics as alternate material for manufacturing farm equipment and machinery.	11
4	Plastics for aquacultural engineering and animal husbandry- animal shelters, vermi-beds and inland fisheries. Silage film technique for fodder preservation. Agencies involved in the promotion of plasticulture in agriculture at national and state level. Human resource development in plasticulture applications.	8

Suggested Reading

Srivastava PK, Singh RK, and Singh B. 2022. Plastic in Agriculture, Brillion Publishing.

Course Outcomes:

After completion of the course the students will be able to

CO1: Identify the types and quality of plastics used in agriculture.

CO2: Discuss the use of plastics in irrigation and water harvesting.

CO3: Illustrate the use of polymer in control of percolation losses.

CO4: Analyze the use of plastic in crop protection.

CO5: Evaluate the use of plastics for innovative packaging solutions for processed food products.

CO6: Develop modern farm equipment and machinery model with the use of plastics.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
5	Professional Elective – I (Seed Technology and Processing)	PE-AE 501 (C)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge of Seed technology and seed processing.
2. To apply seed processing and storage techniques include cleaning, sorting, drying, conditioning and management.

Pre-requisite:

1. Mathematics
2. Physics
3. Agriculture for Engineers

Unit	Contents	Hrs./Unit
1	Identification of seeds of different varieties of common crops, selection of land, isolation distance, seed treatment, agronomic practices and seed yield. Concept of hybrid seed, crops and varieties, adjusting sowing/transplanting, row ratio, harvesting and threshing. Integrated pest- disease management, insect-pest and diseases of different crops, symptoms of damage, control measures, economic threshold level. Concept of seed health, methods and tests of primary seed health.	14
2	Introduction to seed processing, Importance of good quality seed in crop production and higher productivity, Basic principles and steps in seed processing, Methods of seed processing – manual and mechanical, Principles of safety, hygiene and sanitation in seed processing.	7
3	Basic servicing and maintenance of various equipments, machines involved in processing. Idea on seed certification labels and producer cards. Need of seed storage, types of storage containers, go-down for different crops. Concept on storage environment, factors in deterioration of seed quality in storage and precautionary management.	12
4	Introduction and importance of seed quality.	12

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	Method of sample collection, and preparation of working samples before seed test. Methods of seed testing. Idea on seed market chain, factors involved in seed marketing, demand forecast, price competitiveness. Knowledge on seed license, registration of seed units, Govt. Schemes, GST etc.	
--	--	--

Suggested Reading

Kanwar, H.S. 2012. Seed Technology Processing Storage & Marketing, 1/e HB.

Course Outcomes:

After completion of the course the students will be able to

CO1: Identify seeds of different varieties of common crops.

CO2: Describe the seed health and related tests and methods.

CO3: Illustrate different seed processing techniques.

CO4: Categorize machines needed for seed processing and technology.

CO5: Choose necessary storage for seed quality and precautionary management.

CO6: Generalize the knowledge on seed license and Govt schemes.

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
6	Open Elective – I (Fundamentals of Renewable Energy Sources)	OE-AE 501 (A)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To establish the basic concept of renewable energy sources.
2. To design biogas plants.

Pre-requisite:

1. Mathematics
2. Physics
3. Chemistry

Unit	Contents	Hrs./Unit
1	Concept and limitation of Renewable Energy Sources (RES), Criteria for assessing the potential of RES, Classification of RES, Solar, Wind, Geothermal, Biomass, Ocean energy sources, Comparison of renewable energy sources with non renewable sources. Hydropower plant and its working principle. Solar Energy: Energy available from Sun, Solar radiation data, solar energy conversion into heat rough, Flat plate and	14

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	Concentrating collectors, different solar thermal devices, Principle of natural and forced convection drying system.	
2	Solar Photovoltaics: p-n junctions. Solar cells, PV systems, Stand alone, Grid connected solar power station, Calculation of energy through photovoltaic power generation and cost economics. Wind Energy: Energy available from wind, General formula, Lift and drag. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Types of Windmill rotors.	12
3	Determination of torque coefficient, Induction type generators, Working principle of wind power plant. Bio-energy: Pyrolysis of Biomass to produce solid, liquid and gaseous fuels. Biomass gasification, Types of gasifier, various types of biomass cook stoves for rural energy needs.	10
4	Biogas: types of biogas plants, biogas generation, factors affecting biogas generation and usages, design consideration, advantages and disadvantages of biogas spent slurry. Different types of Biogas Plants model and designing of them. Briquetting machines and balers; biodiesel utilization in CI engines.	9

Suggested Reading

Rai, G.D. 2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.

Rai, G.D., Solar Energy Utilization, Khanna Publishers, Delhi.

Khandelwal, K.C. & S. S. Mahdi. 1990. Biogas Technology- A Practical Handbook.

Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Non Conventional Energy Sources, Himanshu Publications.

Tiwari, G.N. and Ghoshal, M.K. 2005. Renewable Energy Resources: Basic Principles and Applications. Narosa Pub. House. Delhi.

Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Renewable Energy, Theory and Practice, Himanshu Publications.

Tiwari, G.S. and Ghosal, S.K. Fundamental of Renewable Energy Sources.

Course Outcomes:

After completion of the course the students will be able to

CO1: Identify the renewable and non-renewable energy sources.

CO2: Describe the working principle of hydropower plant.

CO3: Explain the working principle of PV cells.

CO4: Categorize various solar gadgets recently used in our country.

CO5: Estimate the design parameters of windmill.

CO6: Design various types of biogas plants.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
6	Open Elective – I (Bio-energy Systems: Design and Applications)	OE-AE 501 (B)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To establish an overview of aerobic and anaerobic fermentation process in industrial application.
2. To explain biodiesel production.

Pre-requisite:

1. Mathematics
2. Physics
3. Chemistry
4. Engineering thermodynamics

Unit	Contents	Hrs./Unit
1	Fermentation processes and its general requirements, An overview of aerobic and anaerobic fermentation processes and their industrial application. Heat transfer processes in anaerobic digestion systems, land fill gas technology and potential. Biomass Production: Wastelands, classification and their use through energy plantation, selection of species, methods of field preparation and transplanting.	12
2	Harvesting of biomass and coppicing characteristics. Biomass preparation techniques for harnessing (size reduction, densification and drying). Thermo-chemical degradation. History of small gas producer engine system.	12
3	Chemistry of gasification. Gas producer – type, operating principle. Gasifier fuels, properties, preparation, conditioning of producer gas. Application, shaft power generation, thermal application and economics.	12
4	Trans-esterification for biodiesel production. A range of bio-hydrogen production routes. Environmental aspect of bio-energy, assessment of greenhouse gas mitigation potential.	9

Suggested Reading

British BioGen. 1997, Anaerobic digestion of farm and food processing practices- Good practice guidelines, London, available on www.britishbiogen.co.uk.

Butler, S. 2005. Renewable Energy Academy: Training wood energy professionals. Centre for biomass energy. 1998. Straw for energy production; Technology- Environment-Ecology. Available: www.ens.dk.

Course Outcomes:

After completion of the course the students will be able to

CO1: Define aerobic and anaerobic fermentation processes.

CO2: Discuss about landfill gas technology and potential.

CO3: Illustrate biomass production and their use through biomass plantation.

CO4: Analyse small gas holder engine system.

CO5: Assess the chemistry of gasification.

CO6: Express about trans-esterification process.

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
6	Open Elective – I (Building Construction and Cost Estimation)	OE-AE 501 (C)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To develop the basic knowledge about building materials and its properties.
2. To design agricultural buildings as per need.

Pre-requisite:

1. Mathematics
2. Physics
3. Engineering drawing

Unit	Contents	Hrs./Unit
1	Building Materials: Rocks, Stones, Bricks Properties and varieties of Tiles, Lime, Cement, Concrete, Sand. Glass, Rubber, Plastics, iron, Steel, Aluminium, Copper, Nickel. Timber. Building components: Lintels, Arches, stair cases, Different types of floors, Finishing: Damp Proofing and water proofing, Plastering, pointing, white washing and distempering –Painting.	12
2	Building design, Design procedures, Technology, building construction, Types of agricultural buildings and related needs, application of design theory and practice to the conservation, sloped and flat roof buildings.	12

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

3	Construction economics: Preliminary estimates, Detailed Estimates of Buildings source of cost information, use of cost analyses for controlling design, Factors affecting building costs; cost evaluation of design and planning alternatives for building and estate development.	12
4	Measurement and pricing, Economic methods for evaluating investments in buildings and building systems: cost-in-use, benefit-to-costs and savings-to-investment ratios, rate of return, net benefits, payback.	9

Suggested Reading

Punmia B.C. Ashok Kumar Jain and Arun Kumar Jain. Building Construction. Laxmi Publications (P) Ltd., New Delhi.

Duggal S K. Building material. New Age International Publishers.

Sane Y.S. Planning and Designing of Buildings.

Rangwala S C. 1994. Engineering Materials. Charotar Publishing House, Anand.

Dutta B.N. 2000. Estimating and Costing. UBS publishers.

Course Outcome:

After completion of the course the students will be able to

CO1: Identify the properties of building materials.

CO2: Understand the building components.

CO3: Illustrate the application of different types of building theories and their conservation.

CO4: Focus on the economic methods for evaluating investments in buildings and building systems

CO5: Estimate the building construction costs.

CO6: Plan and design different types of agricultural buildings.

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
7	Agriculture Economics	HM-AE 501	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To develop the fundamental knowledge of Agricultural economics.
2. To explain the term related to economics and to explain cost analysis.

Pre-requisite:

1. Mathematics
2. Agriculture for Engineers

Unit	Contents	Hrs./Unit
1	Economic Decisions Making – Overview, Problems, Role, Decision making process. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs,	10

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.	
2	Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value Of Money, Debt repayment, Nominal & Effective Interest. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives. Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate Of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.	12
3	Uncertainty in future events - estimates & their use in economic analysis, range of estimates, probability, joint probability distributions, expected value, economic decision trees, risk, risk vs return, simulation, real options. Depreciation - basic aspects, deterioration & obsolescence, depreciation and expenses, types of property, depreciation calculation fundamentals, depreciation and capital allowance methods, straight-line depreciation declining balance depreciation, common elements of tax regulations for depreciation and capital allowances.	10
4	Replacement Analysis - replacement analysis decision map, minimum cost life of a new asset, marginal cost, minimum cost life problems. Inflation And Price Change – definition, effects, causes, and price change with indexes, types of index, composite vs commodity indexes, use of price indexes in engineering economic analysis, cash flows that inflate at different rates.	7
5	Accounting – function, balance sheet, income	6

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	statement, financial ratios capital transactions, cost accounting, direct and indirect costs, indirect cost allocation.	
--	---	--

Text and Reference Books:

1. James L. Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP
3. John A. White, Kenneth E. Case, David B. Pratt : Principle of Engineering Economic Analysis, John Wiley
4. Sullivan and Wicks: Engineering Economy, Pearson
5. R. Paneer Seelvan: Engineering Economics, PHI
6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub
7. Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House, New Delhi.

Course Outcome:

After completion of the course the students will be able to

CO1: Define agricultural economics.

CO2: Understand the overview of economic decisions making.

CO3: Explain the viewpoint of Economic Analysis Studies.

CO4: Focus on the basic concepts of depreciation and methods for calculating depreciation.

CO5: Calculate depreciation costs.

CO6: Express Inflation, Price change and the concepts of Accounting.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Practical & Sessional:

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
1	Farm Machinery Lab	PC-AE 591	100	0	0	3	1.5

Objective:

3. To identify the materials of construction in agricultural machinery.
4. To evaluate the performance of different machineries.

Unit	Contents	No. of Practical Class
1	Study on primary tillage implements – construction, operation, adjustments, and calculations of power and draft.	3
2	Study on secondary tillage implements – construction, operation, adjustments, and calculations of power and draft.	3
3	Study on IC Engine – Construction, Classification, Operation, Adjustments, and Calculations of Power and Efficiency.	4
4	Study of sowing and planting equipment – construction, types, calculations for calibration, adjustments, and calculations of field capacity.	3
5	Study of transplanters – paddy, vegetable, etc.) Identification of materials for construction in agricultural machinery and study of material properties.	3
6	Weeding equipment's and their use, study of sprayers, dusters, measurement of nozzle discharge field capacity, etc.	3
7	Study crop harvesting, threshing, and chaff cutting machinery, their functional components, methods of operation, and capacity calculations.	3
Total		22

Text and reference books:

Text:

- 1 Kepner RA, Roy Barger & EL Barger. Principles of Farm Machinery.
- 2 Lal Radhey and AC Datta. Agricultural Engineering.

Reference:

- 3 Smith HP and LH Wilkey. Farm Machinery and Equipment.
- 4 Srivastava AC. Elements of Farm Machinery.

Course Outcome:

After the completion of the course, the students will be able to

CO1: Define the primary and secondary tillage implements.

CO2: Identify different components of the IC engine.

CO3: Illustrate the mechanism of sowing and planting equipments.

CO4: Focus on different components of the transplanters and weeding equipments.

CO5: Assess the working principle of plant protection.

CO6: Modify the design of harvesting, threshing, and chaff cutting machinery.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
2	Irrigation & Drainage Engineering Lab	PC-AE 592	100	0	0	3	1.5

Objective:

1. To measure soil moisture, evapotranspiration, infiltration and hydraulic conductivity.
2. To evaluate different irrigation methods and drainage systems.

Unit	Contents	No. of Practical Class
1	Measurement of soil moisture by different soil moisture measuring instruments;	2
2	Measurement of irrigation water; Measurement of infiltration characteristics; Determination of bulk density, field capacity and wilting point.	2
3	Estimation of evapotranspiration; Study of land grading methods; Design of underground pipeline system; Estimation of irrigation efficiency.	3
4	Study of advance, recession and computation of infiltration opportunity time; infiltration by inflow-outflow method.	2
5	Evaluation of different irrigation methods.	2
6	<i>In-situ</i> measurement of hydraulic conductivity by single auger hole and inverse auger hole method; Estimation of drainage coefficients; Study of piezometer and observation wells.	3
7	Preparation of iso-bath and isobar maps; Determination of drainable porosity; Design of surface drainage systems; Study of gravel envelop; Design of subsurface drainage systems.	4
8	Study of chemical properties of soil and water; Study of drainage tiles and pipes; Cost analysis of surface and sub-surface drainage system.	4
Total		22

Text and reference books:

Text:

1. Murthy VVN. 2013. Land and Water Management Engineering. Kalyani Publishers, New Delhi.
2. Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing House New Delhi.

Reference:

1. Bhattacharya AK and Michael AM. 2013. Land Drainage, Principles, Methods and Applications. Vikas Publication House, Noida (UP)
2. Ritzema H.P. 1994. Drainage Principles and Applications, ILRI Publication 16, Second Edition (Completely Revised)
3. Michael AM. and Ojha TP. 2014. Principles of Agricultural Engineering Vol-II 5th Edition. Jain Brothers Publication, New Delhi
4. Kadam U.S., Thokal R.T., Gorantiwar S.D. and Powar A.G. 2007. Agricultural Drainage-Principles and Practices, Westville Publishing House
5. FAO Irrigation and Drainage Paper No. 6, 9, 15, 16, 28 and 38. Rome, Italy.
6. Majumdar D. K. 2013. Irrigation Water Management Principles. PHI learning Private Limited New Delhi 2nd Edition.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

- Allen R. G., L. S. Pereira, D. Raes, M. Smith. 1998. Crop Evapotranspiration guidelines for computing crop water requirement. Irrigation and drainage Paper 56, FAO of United Nations, Rome.
- Israelsen O W. and Hansen V. E and Stringham G. E. 1980. Irrigation Principles and Practice, John Wiley & Sons, Inc. USA.

Course Outcomes:

After completion of the course the students will be able to

- CO1:** Recognize different soil moisture measuring instruments.
CO2: Understand the basics of water infiltration
CO3: Explain different structures for irrigation and drainage purpose
CO4: Analyze different design parameters for irrigation and drainage system
CO5: Determine crop irrigation requirement and drainage spacing
CO6: Design advance irrigation and drainage system

Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
3	Post Harvest Engineering Lab	PC-AE 593	100	0	0	2	1

Objective:

- To evaluate the performance of different post harvest engineering equipments.
- To visit to grain processing industries.

Unit	Contents	No. of practicals
1	Performance evaluation of different types of cleaners and separators, Determination of separation efficiency, Study of different size reduction machines and performance evaluation.	3
2	Determination of fineness modulus and uniformity index, Study of different types of conveying and elevating equipments, Study of different types of mixers.	3
3	Measurement of moisture content: dry basis and wet basis. Study on drying characteristics of grains and determination of drying constant, Determination of EMC (Static and dynamic method), Study of various types of dryers, Study of different equipment's in rice mills and their performance evaluation,	3
4	Performance evaluation of peeler and slicer, Performance evaluation of juicer and pulper, Performance evaluation of blanching equipment, Testing adequacy of blanching	2
5	Study of cold storage and its design, Study of CAP and MAP storage, Minimal processing of vegetables, Preparation of value-added products.	3
6	Visit to grain processing industries.	1
Total		15

Text and reference books:

Text:

- Chakraverty, A. Post Harvest Technology of cereals, pulses and oilseeds. Oxford & IBH publishing Co. Ltd., New Delhi.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

2. Dash, S.K., Bebartta, J.P. and Kar, A. Rice Processing and Allied Operations. Kalyani Publishers, New Delhi.
3. Sahay, K.M. and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas Publishing house Pvt. Ltd. New Delhi.
4. Geankoplis C. J. Transport processes and unit operations, Prentice Hall of India Pvt Ltd, New Delhi

Reference:

1. Earle, R.L. 2003. Unit Operations in Food Processing. Pergamon Press. Oxford. U.K.
2. Henderson, S.M., and Perry, R. L. Agricultural Process Engineering, Chapman and hall, London
3. McCabe, W.L., Smith J.C. and Harriott, P. Unit operations of Chemical Engineering. McGraw Hill.
4. Singh, R. Paul. and Heldman, R. Dennis. 2004. Introduction to Food Engineering. 3rd Edition. Academic Press, London.

Course Outcome:

After completion of the course the students will be able to

CO1: Identify the separation efficiency of different equipments.

CO2: Discuss the fitness modulus.

CO3: Examine the uniformity coefficient.

CO4: Calculate and evaluate the EMC and the performance of grain milling.

CO5: Construct and assess the process flow charts of grain processing industries.

CO6: Design and test the different types of storage plant.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

**Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)****Curriculum Structure****SEMESTER-VI**

Theory							
Sl. No.	Subject Name	Subject Code	Marks	L	T	P	Credit
1	Soil and Water Conservation Engineering	PC-AE 601	100	3	0	0	3
2	Entrepreneurship Development & Business Management	HM-AE 601	100	3	0	0	3
3	Professional Elective – II (Groundwater, Wells and Pumps/ Watershed Planning & Management/ Pressurised Irrigation System)	PE-AE 601 (A/B/C)	100	3	0	0	3
4	Professional Elective – III (Tractor and Farm Machinery Operation and Maintenance/ Tractor Systems and Controls/ Pump Engineering & Hydraulic Control)	PE-AE 602 (A/B/C)	100	3	0	0	3
5	Open Elective – II (Database Management System/ Data Structure & Algorithm/ Web Designing and Internet Applications)	OE-AE 601 (A/B/C)	100	3	0	0	3
6	Ethics in Engineering Practice/ Essence of Indian Knowledge Tradition	MC-AE 601	100	2	0	0	2

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

**Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)**

Total Marks: 600		Total Credit: 17					
Practical							
1	Soil and Water Conservation Engineering Lab	PC-AE 691	100	0	0	3	1.5
2	Open Elective – II Lab (Database Management System Lab)	OE-AE 691	100	0	0	3	1.5
3	Industrial Internship – I	SI-AE 681	100	0	2	0	2
Total Marks: 300		Total Credit: 5					
Total Credit							22(17+5)

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Theory:

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Soil and Water Conservation Engineering	PC-AE 601	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks End

Semester Exam: 70 marks

Objective:

1. To understand the importance of soil and water conservation.
2. To apply engineering control measures for soil and water conservation.

Pre-requisite:

1. Watershed hydrology
2. Agriculture for engineers

Unit	Contents	Hrs./Unit
1	Soil erosion - Introduction, causes and types - geological and accelerated erosion, agents, factors affecting and effects of erosion. Water erosion - Mechanics and forms - splash, sheet, rill, gully, ravine and stream bank erosion. Gullies - Classification, stages of development. Soil loss estimation - Universal soil loss equation (USLE) and modified USLE. Rainfall erosivity - estimation by KE ₂₅ and EI ₃₀ methods. Soil erodibility - topography, crop management and conservation practice factors.	14
2	Measurement of soil erosion - Runoff plots, soil samplers. Water erosion control measures - agronomical measures - contour farming, strip cropping, conservation tillage and mulching. Engineering measures - Bunds and terraces. Bunds - contour and graded bunds - design and surplusing arrangements. Terraces - level and graded broad base terraces, bench terraces - planning, design and layout procedure, contour stonewall and trenching.	14
3	Gully and ravine reclamation - principles of gully control - vegetative measures, temporary structures and diversion drains. Grassed waterways and design.	7
4	Wind erosion - Factors affecting, mechanics, soil loss estimation and control measures - vegetative, mechanical measures, wind	10

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	breaks and shelter belts and stabilization of sand dunes. Land capability classification. Rate of sedimentation, silt monitoring and storage loss in tanks.	
--	---	--

Suggested Reading

Singh Gurmel, C. Venkataraman, G. Sastry and B.P. Joshi. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service, New Delhi.

Mal, B.C. 2014. Introduction to Soil and Water Conservation Engineering. 2014. Kalyani Publishers.

Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.

Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.

Norman Hudson. 1985. Soil Conservation. Cornell University Press, Ithaca, New York, USA.

Frevert, R.K., G.O. Schwab, T.W. Edminster and K.K. Barnes. 2009. Soil and Water Conservation Engineering, 4th Edition, John Wiley and Sons, New York.

Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.

Course Outcome:

After completion of the course the students will be able to

CO1: Read the basic concept of soil and water conservation.

CO2: Explain the causes and effects of soil loss.

CO3: Illustrate the water and wind erosion.

CO4: Calculate the soil loss through water and wind.

CO5: Assess the gully erosion.

CO6: Design terraces, bunds, waterways and other control measures.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
2	Entrepreneurship Development & Agribusiness Management	HM-AE 601	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the basic concept of Entrepreneurship and management.
2. To analyze the role of Entrepreneurship development in economic development of a country.

Pre-requisite:

1. Extension education
2. Agriculture economics

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

**Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)**

Unit	Contents	Hrs./Unit
1	Entrepreneurship, management – Management functions – planning- Organizing – Directing – motivation – ordering – leading – supervision- Communication and control – Capital – Financial management – importance of financial statements – balance sheet – profit and loss statement, Analysis of financial statements – liquidity ratios – leverage ratios, Coverage ratios – turnover ratios – profitability ratios, Agro-based industries – Project – project cycle – Project appraisal and evaluation techniques – undiscounted measures – payback period – proceeds per rupee of outlay, Discounted measures – Net Present Value (NPV) – Benefit-Cost Ratio (BCR) – Internal Rate of Return (IRR)	14
2	Net benefit investment ratio (N / K ratio) – sensitivity analysis-Importance of agribusiness in Indian economy International trade-WTO agreements – Provisions related to agreements in agricultural and food commodities. Agreements on agriculture (AOA) – Domestic supply, market access, export subsidies agreements on sanitary and phyto-sanitary (SPS) measures, Trade related intellectual property rights (TRIPS). Development (ED): Concept of entrepreneur and entrepreneurship Assessing overall business environment in Indian economy– Entrepreneurial and managerial characteristics	14
3	Entrepreneurship development Programmes (EDP) - Generation incubation and commercialization of ideas and innovations- Motivation and entrepreneurship development- Globalization and the emerging business entrepreneurial environment- Managing an enterprise: Importance of planning, budgeting, monitoring evaluation and follow-up managing competition. Role of ED in economic development of a country- Overview of Indian social, political systems and their implications for decision making by individual entrepreneurs- Economic system and its implications for decision making by individual entrepreneurs-Social responsibility of business.	9
4	Morals and ethics in enterprise management- SWOT analysis- Government schemes and incentives for promotion of entrepreneurship.	8

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	Government policy on small and medium enterprises (SMEs)/SSIs/MSME sectors- Venture capital (VC), contract farming (CF) and joint ventures (JV), public-private partnerships (PPP)- Overview of agricultural engineering industry, characteristics of Indian farm machinery industry	
--	--	--

Suggested Reading

- Harsh, S.B., Conner, U.J. and Schwab, G.D. 1981. Management of the Farm Business. Prentice Hall Inc., New Jersey.
- Joseph, L. Massie. 1995. Essentials of Management. Prentice Hall of India Pvt. Ltd., New Delhi.
- Omri Rawlins, N. 1980. Introduction to Agribusiness. Prentice Hall Inc., New Jersey
- Gittenger Price, J. 1989. Economic Analysis of Agricultural Projects. John Hopkins University, Press, London.
- Thomas W Zimmer and Norman M Scarborough. 1996. Entrepreneurship. Prentice-Hall, New Jersey.
- Mark J Dollinger. 1999. Entrepreneurship Strategies and Resources. Prentice-Hall, Upper Saddal Rover, New Jersey.
- Khanka S S. 1999. Entrepreneurial Development. S. Chand and Co. New Delhi.
- Mohanty S K. 2007. Fundamentals of Entrepreneurship. Prentice Hall India Ltd., New Delhi.

Course Outcome:

After completion of the course the students will be able to

CO1: Read the basic concept of Entrepreneurship and management.

CO2: Explain the Net benefit investment ratio.

CO3: Illustrate the Entrepreneurship development Programmes.

CO4: Analyze the role of Entrepreneurship development in economic development of a country.

CO5: Assess the Morals and ethics in enterprise management- SWOT analysis.

CO6: Assemble government policy on small and medium enterprises (SMEs)/SSIs/MSME sectors.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
3	Professional Elective – II (Groundwater, Wells and Pumps)	PE-AE 601 (A)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks End

Semester Exam: 70 marks

Objective:

1. To understand the basic concept of Occurrence and movement of ground water.
2. To analyze the role of wells and pumps.

Pre-requisite:

1. Watershed hydrology
2. Fluid mechanics

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Unit	Contents	Hrs./Unit
1	Occurrence and movement of ground water; aquifer and its types; classification of wells, fully penetrating tube-wells and open wells, familiarization of various types of bore wells; design of open wells; groundwater exploration techniques; methods of drilling of wells: percussion, rotary, reverse rotary; design of tube-well and gravel pack, installation of well screen, completion and development of well;	14
2	Groundwater hydraulics-determination of aquifer parameters by different method such as Theis, Jacob and Chow's, Theis recovery method; well interference, multiple well systems, estimation of ground water potential, quality of ground water; artificial groundwater recharge techniques; pumping systems: water lifting devices;	14
3	Different types of pumps, classification of pumps, component parts of centrifugal pumps, priming, pump selection, installation and trouble shooting, performance curves, effect of speed on capacity, head and power, effect of change of impeller dimensions on performance characteristics;	11
4	Hydraulic ram, propeller pumps, mixed flow pumps and their performance characteristics; deep well turbine pump and submersible pump.	6

Suggested Reading

Michael AM, Khepar SD. and SK Sondhi. 2008. Water Well and Pumps, 2nd Edition, Tata Mc-Graw Hill.

Todd David Keith and Larry W. Mays. 2004. Groundwater Hydrology, 3rd Edition, John Wiley & Sons, New York (International Book Distributing Company Lucknow).

Michael AM. and Ojha TP. 2014. Principles of Agricultural Engineering Vol-II, 5th Edition. Jain Brothers Publication, New Delhi.

Course Outcome:

After completion of the course the students will be able to

CO1: Read the basic concept of Occurrence and movement of ground water.

CO2: Explain the aquifer and its types.

CO3: Illustrate the groundwater exploration techniques.

CO4: Analyze the Groundwater hydraulics.

CO5: Assess the aquifer parameters by different methods.

CO6: Design water lifting devices.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
3	Professional Elective – II (Watershed Planning & Management)	PE-AE 601 (B)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks End

Semester Exam: 70 marks

Objective:

1. To understand the basic concept of Watershed.
2. To analyze the Water budgeting in a watershed.

Pre-requisite:

1. Watershed hydrology
2. Agriculture for engineers

Unit	Contents	Hrs./Unit
1	Watershed - introduction and characteristics. Watershed development - problems and prospects, investigation, topographical survey, soil characteristics, vegetative cover, present land use practices and socio-economic factors. Watershed management - concept, objectives, factors affecting, watershed planning based on land capability classes, hydrologic data for watershed planning, watershed codification, delineation and prioritization of watersheds – sediment yield index.	14
2	Water budgeting in a watershed. Management measures - rainwater conservation technologies - <i>in-situ</i> and <i>ex-situ</i> storage, water harvesting and recycling. Dry farming techniques - inter-terrace and inter-bund land management. Integrated watershed management - concept, components, arable lands - agriculture and horticulture, non-arable lands - forestry, fishery and animal husbandry.	12
3	Effect of cropping systems, land management and cultural practices on watershed hydrology. Watershed programme - execution, follow-up practices, maintenance, monitoring and evaluation.	8
4	Participatory watershed management - role of watershed associations, user groups and self-	11

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	help groups. Planning and formulation of project proposal for watershed management programme including cost-benefit analysis.	
--	---	--

Suggested Reading

- Ghanshyam Das. 2008. Hydrology and Soil Conservation Engineering: Including Watershed Management. 2nd Edition, Prentice-Hall of India Learning Pvt. Ltd., New Delhi.
- Katyal, J.C., R.P. Singh, Shrinivas Sharma, S.K. Das, M.V. Padmanabhan and P.K. Mishra. 1995. Field Manual on Watershed Management. CRIDA, Hyderabad.
- Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service. New Delhi.
- Sharda, V.N., A.K. Sikka and G.P. Juyal. 2006. Participatory Integrated Watershed Management: A Field Manual. Central Soil and Water Conservation Research and Training Institute, Dehradun.
- Singh, G.D. and T.C. Poonia. 2003. Fundamentals of Watershed Management Technology. Yash Publishing House, Bikaner.
- Singh, P.K. 2000. Watershed Management: Design and Practices. E-media Publications, Udaipur.
- Singh, R.V. 2000. Watershed Planning and Management. Yash Publishing House, Bikaner.
- Tideman, E.M. 1999. Watershed Management: Guidelines for Indian Conditions. Omega Scientific Publishers, New Delhi.

Course Outcome:

After completion of the course the students will be able to

CO1: Read the basic concept of Watershed.

CO2: Explain the Watershed development.

CO3: Illustrate the Water budgeting in a watershed.

CO4: Analyze the hydrologic data for watershed planning.

CO5: Assess the effect of cropping systems, land management and cultural practices on watershed hydrology.

CO6: Plan and formulate project proposal for watershed management programme including cost-benefit analysis.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
3	Professional Elective – II (Pressurised Irrigation System)	PE-AE 601 (C)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks End

Semester Exam: 70 marks

Objective:

1. To understand the basic concept of pressurized irrigation.
2. To analyze the performance of pressurized irrigation system.

Pre-requisite:

1. Irrigation and drainage engineering
2. Agriculture for engineers

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Unit	Contents	Hrs./Unit
1	Sprinkler irrigation: adaptability, problems and prospects, types of sprinkler irrigation systems; design of sprinkler irrigation system: layout selection, hydraulic design of lateral, sub-main and main pipe line, design steps;	14
2	Selection of pump and power unit for sprinkler irrigation system; performance evaluation of sprinkler irrigation system: uniformity coefficient and pattern efficiency;	7
3	Micro Irrigation Systems: types-drip, spray, & bubbler systems, merits and demerits, different components; Design of drip irrigation system: general considerations, wetting patterns, irrigation requirement, emitter selection, hydraulics of drip irrigation system, design steps; necessary steps for proper operation of a drip irrigation system;	12
4	Maintenance of micro irrigation system: clogging problems, filter cleaning, flushing and chemical treatment; fertigation: advantages and limitations of fertigation, fertilizers solubility and their compatibility, precautions for successful fertigation system, fertigation frequency, duration and injection rate, methods of fertigation.	12

Suggested Reading

Keller Jack and Bliesner Ron D. 2001. Sprinkle and Trickle Irrigation. Springer Science+ business Media, New York .

Mane M.S. and Ayare B.L. 2007. Principles of Sprinkler Irrigation systems, Jain Brothers, New Delhi.

Mane M.S and Ayare B.L. and Magar S.S. 2006. Principles of Drip Irrigation systems, Jain Brothers, New Delhi.

Michael AM, Shrimohan and KR Swaminathan. Design and evaluation of irrigation methods, (IARI Monograph No.1). Water Technology Centre, IARI New Delhi.

Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing Vikas Pub. House New Delhi.

Choudhary M.L and Kadam U.S 2006. Micro irrigation for cash crops Westville Publishing House.

Course Outcome:

After completion of the course the students will be able to

CO1: Read the basic concept of pressurized irrigation.

CO2: Explain the types of pressurized irrigation systems.

CO3: Illustrate the hydraulics of pressurized irrigation.

CO4: Analyze the necessary steps for proper operation of pressurized irrigation.

CO5: Assess the performance of pressurized irrigation system.

CO6: Design the pressurized irrigation system.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
4	Professional Elective – III (Tractor and Farm Machinery Operation and Maintenance)	PE-AE 602 (A)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks End

Semester Exam: 70 marks

Objective:

1. To understand the basic concept of Tractor and Farm machinery operation and maintenance.
2. To analyze the repair and maintenance of implements.

Pre-requisite:

1. Farm machinery and equipment
2. Agriculture for engineers

Unit	Contents	Hrs./Unit
1	Familiarization with different makes and models of agricultural tractors. Identification of functional systems including fuels system, cooling system, transmission system, steering and hydraulic systems. Study of maintenance points to be checked before starting a tractor. Familiarization with controls on a tractor. Safety rules and precautions to be observed while driving a tractor. Driving practice of tractor.	14
2	Practice of operating a tillage tool (mould-board plough/ disc plough) and their adjustment in the field. Study of field patterns while operating a tillage implement. Hitching & De-hitching of mounted and trail type implement to the tractor. Driving practice with a trail type trolley – forward and in reverse direction. Introduction to tractor maintenance – precautionary and break-down maintenance. Tractor starting with low battery charge.	14
3	Introduction to trouble shooting in tractors. Familiarization with tools for general and special maintenance. Introduction to scheduled maintenance after 10, 100, 300, 600, 900 and 1200 hours of operation. Safety hints. Fuel saving tips. Preparing the tractor for storage. Care and maintenance procedure of agricultural machinery during operation and off-season.	9
4	Repair and maintenance of implements –	8

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	adjustment of functional parameters in tillage implements. Replacement of broken components in tillage implements. Replacement of furrow openers and change of blades of rotavators. Maintenance of cutter bar in a reaper. Adjustments in a thresher for different crops. Replacement of V-belts on implements.	
--	--	--

Suggested Reading

Ghosh RK and S Swan. Practical Agricultural Engineering.
Black PO and WE Scahill. Diesel Engine Manual.
Southorn N. Tractor operation and maintenance.
Jain SC and CR Rai. Farm Tractor Maintenance and Repair.
Operators manuals of tractors.
Service manuals provided by manufacturers.

Course Outcome:

After completion of the course the students will be able to

CO1: Read the basic concept of Tractor and Farm machinery operation and maintenance.

CO2: Explain the functional systems of Tractor.

CO3: Illustrate the Hitching & De-hitching of mounted and trail type implement to the tractor.

CO4: Analyze the trouble shooting in tractors.

CO5: Assess the Repair and maintenance of implements.

CO6: Plan for replacement of broken components in tillage implements.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
4	Professional Elective – III (Tractor Systems and Controls)	PE-AE 602 (B)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks End

Semester Exam: 70 marks

Objective:

1. To understand the need for transmission, differential, brake and hydraulic system in a tractor.
2. To explain principle of operation of different systems.

Pre-requisite:

1. Farm machinery and equipment
2. Agriculture for engineers

Unit	Contents	Hrs./Unit
1	Study of need for transmission system in a tractor. Transmission system – types, major functional systems. Study of clutch – need, types, functional requirements, construction	12

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	and principle of operation. Familiarization with single plate, multi-plate, centrifugal and dual clutch systems. Study of Gear Box – Gearing theory, principle of operation, gear box types, functional requirements, and calculation for speed ratio.	
2	Study of differential system – need, functional components, construction, calculation for speed reduction. Study of need for a final drive. Study of Brake system – types, principle of operation, construction, calculation for braking torque. Study of steering system – requirements, steering geometry characteristics, functional components, calculation for turning radius. Familiarization with Ackerman steering. Steering systems in track type tractors.	12
3	Study of Hydraulic system in a tractor – Principle of operation, types, main functional components, functional requirements. Familiarization with the Hydraulic system adjustments. Study of tractor power outlets – PTO. PTO standards, types and functional requirements. Introduction to traction. Traction terminology. Theoretical calculation of shear force and rolling resistance on traction device.	12
4	Study of wheels and tyres – Solid tyres and pneumatic tyres, tyre construction and tyre specifications. Study of traction aids. Study of tractor mechanics – forces acting on the tractor. Determination of CG of a tractor. Study of tractor static equilibrium, tractor stability especially at turns. Determination of maximum drawbar pull.	9

Suggested Reading

Liljedahl J B and Others. Tractors and Their Power Units.

Rodichev V and G Rodicheva. Tractors and Automobiles.

Singh Kirpal. Automobile Engineering – Vol I.

Heitner Joseph. Automotive Mechanics: Principles and Practices.

C.B.Richey. Agricultural Engineering Handbook.

Sharma, D.N. and Mukesh S. Farm Machinery Design and Problems, Jain Brothers.

Course Outcome:

After completion of the course the students will be able to

CO1: Read the need for transmission, differential, brake and hydraulic system in a tractor.

CO2: Explain the principle of operation of different systems.

CO3: Illustrate the shear force and rolling resistance on traction device.

CO4: Analyze the forces acting on the tractor.

CO5: Assess the CG of a tractor.

CO6: Design the wheels and tyres.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
4	Professional Elective – III (Pump Engineering & Hydraulic Control)	PE-AE 602 (C)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks End

Semester Exam: 70 marks

Objective:

1. To understand Hydraulic Basics.
2. To explain principle of operation of Pumps.

Pre-requisite:

1. Farm machinery and equipment
2. Fluid mechanics

Unit	Contents	Hrs./Unit
1	Hydraulic Basics: Pascal's Law, Flow, Energy, Work, and Power. Hydraulic Systems, Colour Coding, Reservoirs, Strainers and Filters, Filtering Material and Elements. Accumulators, Pressure Gauges and Volume Meters, Hydraulic Circuit, Fittings and Connectors.	12
2	Pumps, Pump Classifications, operation, performance, Displacement, Design of Gear Pumps, Vane Pumps, Piston Pumps. Hydraulic Actuators, Cylinders, Construction and Applications, Maintenance, Hydraulic Motors.	12
3	Valves, Pressure - Control Valves, Directional-Control Valves, Flow-Control Valves, Valve. Installation, Valve Failures and Remedies, Valve Assembly, Troubleshooting of Valves Hydraulic Circuit Diagrams and Trouble shooting. United States of American Standards Institute USASI Graphical Symbols Tractor hydraulics, nudging system, ADDC.	12
4	Pneumatics: Air services, logic units, Fail safe and safety systems Robotics: Application of Hydraulics and Pneumatics drives in agricultural systems, Programmable Logic Controls (PLCs).	9

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Course Outcome:

After completion of the course the students will be able to

CO1: Read the Hydraulic Basics.

CO2: Explain the principle of operation of Pumps.

CO3: Illustrate the Hydraulic Circuit Diagrams and Trouble shooting.

CO4: Categorize the hydraulic systems.

CO5: Assess the application of Hydraulics and Pneumatics drives in agricultural systems.

CO6: Design Gear Pumps.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
5	Open Elective – II (Data Base Management System)	OE-AE 601 (A)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks End

Semester Exam: 70 marks

Objective:

1. To understand concept of DBMS.
2. To explain importance of data structure and be able to correlate future programming structure, and its market issues specific to complex engineering problems.

Pre-requisite:

1. Programming for problem solving

Unit	Contents	Hrs./Unit
1	Introduction: Concept & Overview of DBMS, Data model, Database language, Database administrator, Database users, Three Schema architecture of DBMS.	4
2	Entity-Relationship Model: Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity sets, Extended E-R features.	4
3	Relational Model: Structure of relational Databases, Relational Algebra, Relational; calculus, Extended Relational Algebra operations, Views, Modification of the Database.	4
4	SQL and Integrity Constraints: Concept of DDL, DML, DCL. Basic structure, Set operations, Aggregate functions, Null values, Domain constraints, Referential integrity, Constraints, assertions, views, Nested sub queries, Data base security application development using SQL, Stored procedures and triggers	6

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

5	Relational Database design: Functional dependency, Different anomalies in designing a Database, Normalization using functional dependencies, Decomposition, Boyce-Codd normal form, 3NF, Normalization using multi-valued dependencies, 4NF, 5 NF.	4
6	Internal of RDBMS: Physical data structures, Query optimization: join algorithm, statistics and cost base optimization, Transaction processing, Concurrency control and recovery management: transaction model properties, state serializability, lock base protocols, two phase lockin	4
7	File organization & index structures File & records concepts, Placing file records on disk, Fixed and variable sized records, Types of single –Level index (primary, Secondary, clustering), Multilevel Indexes, Dynamic multilevel indexes using B tree and B+ tree.	4

Text & Reference Books:

1. Abraham Silberschatz, Henry F.Korth,S.Sudarshan,2010,McGraw Hill, ISBN 00352332-1
2. Data CJ –An introduction to database, 8th edition, 0321197849
3. Elmasri and Navathe, Fundamentals of Database system Publishing,ISBN,9780136086208
4. Peter rob, Carlos Coronet, Database systems - Disgn, Edition, 2009, Thomson Learning, ISBN:978-0538469
5. R.P. Mahapatra, Database Management Systems, Khanna Publishing House, New Delhi

Course Outcomes

After completion of the course the students will be able to

CO1: Define and explain introductory concepts of data structure, time and space analysis of algorithms using different asymptotic notations.

CO2: Understand linear data structures with its applications and operations on different Linked lists.

CO3: Illustrate the concept and implementation of stack, queue, dequeue, circular queue, and applications of stack using recursion.

CO4: Analyze non-linear data structure such as trees, its traversal, insertion, deletion, height-balanced and B-trees.

CO5: Evaluate various searching and sorting algorithms, problem analysis and representation of graphs such as BFS and DFS.

CO6: Write the importance of data structure and be able to correlate future programming structure, and its market issues specific to complex engineering problems.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
5	Open Elective – II (Data Structure & Algorithm)	OE-AE 601 (B)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks End

Semester Exam: 70 marks

Objective:

1. To understand basic types for data structure, implementation and application.
2. To explain strength and weakness of different data structures.

Pre-requisite:

1. Programming for problem solving

Unit	Contents	Hrs./Unit
1	Linear Data Structures – Sequential representations, Arrays and Lists, Stacks, Queues and Dqueues, String and their applications. Link Representation – Linearly linked lists, Circularly linked lists, Doubly linked lists and applications.	8
2	Algorithms for creating and manipulating different linear data structures; Non-linear data structure – Trees including Binary Trees, Binary Search Trees, Insertion and Deletion algorithms, Height-balanced and Weight-balanced trees, B-trees.	8
3	Graph Representations, Breadth first search (BFS) and Depth first search (DFS); Graph Theoretic Algorithms – Incidence Matrix, Adjacency Matrix, Algorithms for Minimal Spanning Tree (Prim's and Kruskal's Algorithm).	7
4	Sorting and Searching Algorithms – Bubble sort, Insertion sort, Quick sort, Merge sort; File Structures – Record and Table Structures, Sequential and Direct access, Indexed Files, Inverted Files, Hashed Files	7

Text & Reference Books:

Text:

1. Aho Alfred V., Hopperoft John E., Ullman Jeffrey D., "Data Structures and algorithms", Pearson Education
2. Berman, Data Structure Via C++, OUP

References:

1. Horowitz Ellix & Sartaj Sahani, "Fundamentals of Data Structures", Galgotria Pub.
2. Tenenbaum A. S., "Data Structures using C", Pearson Education/PHI

3. Graph Theory – N. Deo, PHI**Course Outcome:**

After completion of the course the students will be able to

CO1: Define the basic types for data structure, implementation and application.

CO2: Explain the strength and weakness of different data structures.

CO3: Illustrate basic data structures and algorithms for autonomous realization of simple programs or program parts.

CO4: Examine bugs in program; recognise needed basic operations with data structures.

CO5: Assess the appropriate data structure in context of solution of given problem

CO6: Develop programming skills which require solving given problem.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
5	Open Elective – II (Web Designing and Internet Applications)	OE-AE 601 (C)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks End

Semester Exam: 70 marks

Objective:

1. To understand web design.
2. To explain Connectivity of Web pages with databases.

Pre-requisite:

1. Programming for problem solving

Unit	Contents	Hrs./Unit
1	Basic principles in developing a web designing, Planning process, Five Golden rules of web designing, Designing navigation bar,	8
2	Page design, Home Page Layout, Design Concept. Basics in Web Design, Brief History of Internet, World Wide Web , creation of a web site,	8
3	Web Standards, Audience requirement. Introduction to JavaScript, variables & functions,	7
4	Working with alert, confirm and prompt, Connectivity of Web pages with databases; Project	7

Course Outcome:

After completion of the course the students will be able to

CO1: Define the web design.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

- CO2:** Explain the rules of web designing.
CO3: Illustrate JavaScript.
CO4: Analyze Audience requirement.
CO5: Assess the Connectivity of Web pages with databases
CO6: Develop a website.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
6	Ethics in Engineering Practice	MC-AE 601	100	2	0	0	2

Examination Scheme:

Continuous Assessment: 30 marks End

Semester Exam: 70 marks

Objective:

1. To understand Ethical issues in engineering practice.
2. To explain Codes of professional ethics.

Pre-requisite:

1. Professional ethics and IPR

Unit	Contents	Hrs./Unit
1	Indian Ethos- An Overview: Introduction, Indian Ethos, Requisites for Indian Ethos, Indian Ethos for Management, Work Ethos and values for Indian managers, Indian heritage in business, Impact of values on stakeholders, Value system in work culture, Trans-cultural human values, Importance of Karma to managers, Nishkama Karma and its impact on employees today, Teaching Ethics, Gurukul system of learning.	6
2	Understanding Ethics: Ethics- Meaning & Concept, Types of Ethics, Ethics in Work life, Some unethical issues in society, Ethical Theories: Moral Development Theories (Piagets Theory, Kohlberg's Theory, Gilligan's Theory); Basic Theories (Deontology, Utilitarianism, Virtue Theory, Rights Theory), Role of Scriptures in Understanding Ethics.	6
3	Business Ethics: Engineering as a profession, Engineering Ethics, Code of Ethics, Business Ethics – concept, meaning, importance, Factors influencing business ethics, Ethical principles in business, Conflict between business deal and professional ideal, Ethical issues and challenges in business, Ethical governance in business, Good corporate Governance.	6
4	Ethical Dilemma and Ethical Decision Making: Ethical Dilemma, Ethical dilemma in different business areas, Managing ethical dilemmas, Business Decision Making and difficulties, Moral Development and Moral	4

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	Reasoning, Role of moral philosophies in decision making, Using Ethical Reasoning, Ethical Leadership.	
5	Understanding Human Values: Human Values – Meaning and concept, value system, importance, classification, role of socialization in formation of values; Types of Values – <i>Societal values</i> : The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution; <i>Moral and ethical values</i> : Nature of moral judgments; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility; <i>Psychological values</i> : Integrated personality; Maslow's Need Hierarchy theory, mental health, <i>Aesthetic values</i> : Perception and enjoyment of beauty, simplicity, clarity; Meaning of a good life, Value spectrum of a good life, Values Crisis in contemporary society – Individual crisis, Social crisis, Cultural crisis, Intellectual crisis	8

Reference Books:

1. Stephen Hunger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

Course Outcome:

After completion of the course the students will be able to

- CO1:** Define the Ethical issues in engineering practice.
- CO2:** Explain the Conflicts between business demands and professional ideals.
- CO3:** Illustrate Social and ethical responsibilities of Technologists.
- CO4:** Analyze Codes of professional ethics.
- CO5:** Assess the Profession and Human Values
- CO6:** Improve ethics of duty.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
6	Essence of Indian Knowledge Tradition	MC-AE 601	100	2	0	0	2

Examination Scheme:

Continuous Assessment: 30 marks
End Semester Exam: 70 marks

Objective:

1. To understand basics of the Indian traditional knowledge in modern scientific perspective.
2. To explain philosophy of Indian culture.

Haldia Institute of Technology
(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)
Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)

Pre-requisite:

1. Professional ethics and IPR

Unit	Contents	Hrs./Unit
1	Basic structure of Indian Knowledge System (i) Veda, (ii) Upaveda (Ayurveda, Dhanur veda, Gandhar veda, Sthapatya veda) (iii) vedanga (Shiksha, Kalpa, Nirukta, Vyakaran, Jyotisha, Chhanda), (iv) Upanga (Dharma Sartra, Mimamsa, Puran, Tarka sastra)	8
2	Modern Science and Indian Knowledge System	8
3	Yoga and Holistic Health care	7
4	Case studies	7

Text/ Reference Books:

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. Fritz of Capra, The wave of Life
4. V N Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Amakuram
5. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata
6. G N Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016
7. R N Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016
8. P R Sharma (English translation), Shodashang Hridayam

Course Outcome:

After completion of the course the students will be able to

- CO1:** Read the basics of the Indian traditional knowledge in modern scientific perspective.
CO2: Explain the philosophy of Indian culture.
CO3: Illustrate the philosophy of ancient, medieval and modern India.
CO4: Distinguish the information about the fine arts in India.
CO5: Defend the contribution of scientists of different eras
CO6: Improve and modify modern science and Indian knowledge system.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Practical:

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Soil and Water Conservation Engg. Lab	PC-AE 691	100	0	0	3	1.5

Objective:

- To solve the problems on soil loss estimation.
- To design terraces, bunds, waterways and other control measures.

Unit	Contents	No. of practicals
1	Study of different types and forms of water erosion. Exercises on computation of rainfall erosivity index. Computation of soil erodibility index in soil loss estimation. Determination of length of slope (LS) and cropping practice (CP) factors for soil loss estimation by USLE and MUSLE. Exercises on soil loss estimation/measuring techniques.	8
2	Study of rainfall simulator for erosion assessment. Estimation of sediment rate using Coshocton wheel sampler and multi-slot devisor. Determination of sediment concentration through oven dry method.	6
3	Design and layout of contour bunds. Design and layout of graded bunds. Design and layout of broad base terraces. Design and layout of bench terraces. Design of vegetative waterways.	4
4	Exercises on rate of sedimentation and storage loss in tanks. Computation of soil loss by wind erosion. Design of shelterbelts and wind breaks for wind erosion control. Visit to soil erosion sites and watershed project areas for studying erosion control and water conservation measures.	4
Total		22

Suggested Reading

- Singh Gurmel, C. Venkataraman, G. Sastry and B.P. Joshi. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service, New Delhi.
- Mal, B.C. 2014. Introduction to Soil and Water Conservation Engineering. 2014. Kalyani Publishers.
- Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.
- Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
- Norman Hudson. 1985. Soil Conservation. Cornell University Press, Ithaka, New York, USA.
- Frevert, R.K., G.O. Schwab, T.W. Edminster and K.K. Barnes. 2009. Soil and Water Conservation Engineering, 4th Edition, John Wiley and Sons, New York.
- Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.

Course Outcome:

After completion of the course the students will be able to

CO1: Read the basic concept of soil and water conservation.

CO2: Explain the causes and effects of soil loss.

CO3: Illustrate the water and wind erosion.**CO4:** Calculate the soil loss through water and wind.**CO5:** Assess the gully erosion.**CO6:** Design terraces, bunds, waterways and other control measures.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
2	Open Elective – II Lab (Data Base Management System Lab)	OE-AE 691	100	0	0	3	1.5

Objective:

1. To understand concept of DBMS.
2. To explain importance of data structure and be able to correlate future programming structure, and its market issues specific to complex engineering problems.

Unit	Contents	No. of practicals
1	Creating Database: Creating a Database, Creating a table, Specifying Relational Data Types, Specifying Constraints, Creating Indexes.	6
2	Table and record Handling: INSERT statement, Using SELECT and INSERT together, DELETE, UPDATE, TRUNCATE statements, DROP, ALTER statements	4
3	Retrieving Data from Database: The SELECT statement, Using the WHERE clause, Using Logical Operators in the WHERE clause, Using IN, BETWEEN, LIKE, ORDER, BY GROUP BY and HAVING	6
4	Clause: Using AGGREGATE function, Combining Tables using JOINS Sub queries	2
5	Database Management: Creating views ,Creating Column Aliases, Creating Database Users, Using GRANT and REVOKE	2
6	Cursors in Oracle PL / SQL :Writing Oracle PL / SQL Stored Procedures	2
Total		22

Text and Reference Books:

1. Database Systems: A Practical Approach to Design, Implementation and Management” by CONNOLLY.
2. Database Management Systems by R.P. Mahapatra, Khanna Publishing House, New Delhi.

Course Outcomes

After completion of the course the students will be able to

CO1: Define and explain introductory concepts of data structure, time and space analysis of algorithms using different asymptotic notations.

CO2: Understand linear data structures with its applications and operations on different Linked lists.

CO3: Illustrate the concept and implementation of stack, queue, dequeue, circular queue, and applications of stack using recursion.

CO4: Analyze non-linear data structure such as trees, its traversal, insertion, deletion, height-balanced and B-trees.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

CO5: Evaluate various searching and sorting algorithms, problem analysis and representation of graphs such as BFS and DFS.

CO6: Write the importance of data structure and be able to correlate future programming structure, and its market issues specific to complex engineering problems.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
3	Industrial Internship – I	SI-AE 681	100	0	2	0	2

Internship Project Scheme:

Each student will undertake project work assigned to him/her related to design/R&D /industrial problem solving in the area of agricultural engineering under the supervision of a faculty member or a group of faculty member(s) and/or industrial supervisor(s) within a agricultural industry/ allied industries/ testing laboratories/ research institutions/ academia. In principle, the design/development of the internship project work has to be carried out by a group of student(s)/an individual taking advice/guidance from respective supervisor(s) to address the specific problem identified. The internship project work will yield outcome based meaningful results, Scientific publication/ patents. Each student will submit a typed, hard-bound Final Internship Report for the work and its findings. Evaluation will include an oral presentation. Internship Project Dissertation should be carried out in presence of respective supervisor(s) and/ or faculty members and in presence of external examiner(s)/ Central Training & Placement Cell.

Brief Project Outline

1. Brief introduction, objectives & probable outcomes of the projects.
2. Literature survey/secondary search/market survey
3. Manufacturing/prototyping/designing process/products, optimization of processes and characterization through analytical techniques
4. Collection and analysis of data through statistical tools.
5. Conclusion of the project and report preparation
6. Internship Project Dissertation

Course Outcomes:

After completion of the course the students will be able to

CO1: Grasp on engineering principles in the area of agricultural engineering and allied areas.

CO2: Gain knowledge and skills to apply these principles in real-time problem-solving in agricultural engineering and relevant fields.

CO3: Communicate verbally with professional organizations and scientific community with reasonable clarity on topics within agricultural engineering and allied areas.

CO4: Familiar with legislative aspects in India for application of problem solving skills and knowledge acquired in the program.

CO5: Correlate the skills and knowledge acquired over the degree program with a particular job function as a professional.

CO6: Understand the challenges with the exposure to professional responsibilities with appropriate level of accountability.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

**Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)****Curriculum Structure****SEMESTER-VII**

Theory							
Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Dairy and Food Engineering	PC-AE 701	100	3	0	0	3
2	Professional Elective– IV (Waste and By-Product Utilization/Food Packaging Technology/Food quality management)	PE-AE 701 (A/B/C)	100	3	0	0	3
3	Professional Elective– V (Wasteland Development/ Minor Irrigation and Command Area Development / Floods and Control Measures)	PE-AE 702 (A/B/C)	100	3	0	0	3
4	Open Elective –III (Smart Agriculture/Management of Canal Irrigation System/ Precision Farming Techniques for Protected Cultivation)	OE-AE 701 (A/B/C)	100	3	0	0	3
5	Open Elective – IV (Remote Sensing and GIS Application/ Mechanics of Tillage and Traction/ Development of Processed Product)	OE-AE 702 (A/B/C)	100	3	0	0	3
Total Marks: 500			Total Credit: 15				
Practical							
1	Dairy and Food Engineering Lab	PC-AE 791	100	0	0	2	1
2	Industrial Internship–II	SI-AE 781	100	0	2	0	2
3	Project Work and Presentation–I	PW-AE 781	100	-	-	-	4
4	NSS		100	0	0	3	0
Total Marks: 300			Total Credit: 7				
Total Credit						22(15+7)	

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Theory:

Sl. No.	Paper Name	per Code	Marks	L	T	P	Credit
1	Dairy and Food Engineering	PC-AE 701	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the importance of Canning, Aseptic processing, Evaporation of food products: principle, types of evaporators, steam economy, multiple effect evaporation.
2. To know about the Membrane separation, RO, Nano-filtration, Ultra filtration and Macro-filtration, equipment and applications.

Pre-requisite:

1. Refrigeration & Air Conditioning
2. Heat and Mass Transfer
3. Engineering Thermodynamics & Heat Engines

Unit	Contents	Hrs./Unit
1	Deterioration in food products and their controls, Physical, chemical and biological methods of food preservation. Dairy development in India, Engineering, thermal and chemical properties of milk and milk products, Process flow charts for product manufacture, Unit operation of various dairy and food processing systems. Principles and equipment related to receiving of milk, pasteurization, sterilization, homogenization, centrifugation and cream separation. Preparation methods and equipment for manufacture of cheese, <i>paneer</i> , butter and ice cream,	14
2	Filling and packaging of milk and milk products; Dairy plant design and layout, Plant utilities; Principles of operation and equipment for thermal processing, Canning, Aseptic processing, Evaporation of food products: principle, types of evaporators, steam economy, multiple effect evaporation, vapour recompression, Drying of liquid and perishable foods: principles of drying, spray drying, drum drying, freeze drying,	14
3	Filtration: principle, types of filters; Membrane separation, RO, Nano-filtration, Ultra filtration and Macro-filtration, equipment and applications, Non-thermal and other alternate thermal processing in Food processing.	9

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

4	Nanotechnology: History, fundamental concepts, tools and techniques nanomaterials, applications in food packaging and products, implications, environmental impact of nano materials and their potential effects on global economics, regulation of nanotechnology.	8
---	---	---

Suggested Reading

Ahmed, T. 1997. Dairy Plant Engineering and Management. 4th Ed. Kitab Mahal.
McCabe, W.L. and Smith, J. C. 1999. Unit Operations of Chemical Engineering. McGraw Hill.
Rao, D.G. Fundamentals of Food Engineering. PHI learning Pvt. Ltd. New Delhi.
Singh, R.P. & Heldman, D.R. 1993. Introduction to Food Engineering. Academic Press.
Toledo, R. T. 1997. Fundamentals of Food Process Engineering. CBS Publisher.

Course Outcome:

After completion of the course the students will be able to understand the concept of

CO1: Memorize dairy development in India.

CO2: Discuss engineering, thermal and chemical properties of milk and milk products.

CO3: Illustrate the principles of operation and equipment for thermal processing, canning, aseptic processing, and evaporation of food products.

CO4: Analyze Environmental impact of nanomaterials and their potential effects on global economics.

CO5: Compare Membrane separation, RO, Nano-filtration, Ultra filtration and Macro-filtration, equipment and applications.

CO6: Design Process flow charts for product manufacture, Unit operation of various food processing systems.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
2	Professional Elective– IV (Waste and By-Product Utilization)	PE-AE 701 (A)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the importance of waste management and effluent treatment, Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content.
2. To know about the advanced waste water treatment process-sand, coal and activated carbon filters, phosphorous, sulphur, nitrogen and heavy metals removal.

Pre-requisite:

1. Environmental science
2. Biology for engineers
3. Post Harvest Engineering

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Unit	Contents	Hrs./Unit
1	Types and formation of by-products and waste; Magnitude of waste generation in different food processing industries; Uses of different agricultural by-products from rice mill, sugarcane industry, oil mill etc., Concept, scope and maintenance of waste management and effluent treatment, Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues	14
2	Waste utilization in various industries, furnaces and boilers run on agricultural wastes and byproducts, briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization, Waste treatment and disposal, design, construction, operation and management of institutional community and family size biogas plants, concept of vermin-composting, Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation,	16
3	Secondary treatments: Biological and chemical oxygen demand for different food plant waste– trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons,	7
4	Tertiary treatments: Advanced waste water treatment process-sand, coal and activated carbon filters , phosphorous, sulphur, nitrogen and heavy metals removal, Assessment, treatment and disposal of solid waste; and biogas generation, Effluent treatment plants, Environmental performance of food industry to comply with ISO-14001 standards	8

Suggested Reading

Markel, I.A. 1981. Managing Livestock Waste, AVI Publishing Co.

Pantastico, ECB. 1975. Post Harvest Physiology, Handling and utilization of Tropical and Sub-tropical fruits and vegetables, AVI Pub. Co.

Shewfelt, R.L. and Prussi, S.E. 1992. Post-Harvest Handling – A Systems approach, Academic Press Inc.

USDA. 1992. Agricultural Waste Management Field Hand book. USDA, Washington DC.

Weichmann J. 1987. Post Harvest Physiology of vegetables, Marcel and Dekker Verlag.

V.K. Joshi & S.K. Sharma. Food Processing Waste Management: Treatment & Utilization. New India Publishing Agency.

Vasso Oreopoulou and Winfried Russ (Edited). 2007. Utilization of By-products and Treatment of waste

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

in the Food Industry. Springer Science & Business media, LLC 233
New York.

Prashar, Anupama and Bansal, Pratibha. 2007-08. Industrial Safety and Environment. S.K. Kataria and sons, New Delhi

Garg, S K. 1998. Environmental Engineering (Vol. II) – Sewage Disposal and Air Pollution Engineering. Khanna Publishers, New Delhi

Bhatia, S.C.. 2001. Environmental Pollution and Control in Chemical Process Industries. Khanna Publishers, New Delhi.

Course Outcome:

After completion of the course the students will be able to understand the concept of

CO1: Memorize Uses of different agricultural by-products from rice mill, sugarcane industry, oil mill etc.

CO2: Describe Biomass, producer gas generation and utilization, Waste treatment and disposal, design, construction, operation and management.

CO3: Illustrate Different food waste treatment technique.

CO4: Analyze Effluent treatment plants, Environmental performance of food industry.

CO5: Determine Oxygen demands in water body treatment. (BOD, COD).

CO6: Design Advanced waste water treatment process-sand, coal and activated carbon filters.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
2	Professional Elective– IV (Food Packaging Technology)	PE-AE 701 (A/B/C)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the importance of Canning, Aseptic processing, Evaporation of food products: principle, types of evaporators, steam economy, multiple effect evaporation.
2. To know about the Membrane separation, RO, Nano-filtration, Ultra filtration and Macro-filtration, equipment and applications.

Pre-requisite:

1. Refrigeration & Air Conditioning
2. Heat and Mass Transfer
3. Engineering Thermodynamics & Heat Engines

Unit	Contents	Hrs./Unit
1	Definition and Functions of packaging; Type of packaging materials; Selection of packaging material for different foods; Methods of packaging and packaging equipment.	11
2	Mechanical strength of different packaging materials; Printing of packages; Barcodes & other marking; Interactions between packaging material and foods; Environmental and cost consideration in selecting packaging	11

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	materials.	
3	Manufacture of packaging materials; Potential of bio-composite materials for food packaging; Packaging regulations as per FSSAI; Packaging and food preservation;	7
4	Testing of packaging materials (PM) in food industries; Rigid and semi rigid containers; Flexible containers; Sealing equipment; Labeling and symbols used in packaging products; Aseptic and shrink packaging; Secondary and transport packaging. Advances in Packaging Technologies; MAP, CAP, Active packaging, Intelligent Packaging, Nano-Packaging, Irradiated food Packaging.	16

Text and Reference Books:

Text

1. Food Packaging: Principles and Practice by G. L. Robertson. Taylor & Francis Inc.
2. Food Packaging Technology by Richard Coles, Derek MC Dowell and Mark J. Kirwan. Blackwell Publishing, CRC press.
3. Food and Packaging Interactions by Joseph H. Hotchkiss, (ACS symposium series - 365, April 5-10, 1987, American chemical society, Washington DC, 1988.)

Reference

1. Packaging foods with plastics by winter A. Jenkins & James P Harrington – Technomic publishing co. Inc, Lancaster. Basel.
2. Flexible food packaging (Question & Answers) by Arthur Hirsch VNB – Van Nostrand Reinhold, New York (An AVI Book), ISBN 0-442-00609-8.
3. Food Packaging and Preservation (theory & practice) by M. Mathlouthi-Elsevier Applied science publisher, London and New York.
4. Food Packaging Materials (Aspect of Analysis & Migration of contaminants) by N.T. Crosby applied science publishers LTD. London.
5. Plastics in Packaging by A.S Athlye, TMGH, New Delhi.
6. Packaging (specifications, purchasing & Quality Control) 3rd edition by Edmond A Leonard- Marcel Dekker, INC- New York & Basel.
7. Plastics in packaging by forwarded by H.B Ajmera & M.R Subramaniam – Indian institute of packaging. Published by A.P. Vaidya, Secretary IIP, E2, MIDC, Industrial Area Andheri (East), Bombay-400093.
8. Food Packaging- Stanley Sacharois & Roger C. Griffin- The AVI Publishing company Inc. 1970. 9. Principles of packaging development- Griffin & Sacharow. The AVI Publishing company, Inc. 1972.

Course Outcome:

After completion of the course the students will be able to:

CO1: Define, understand, and relate basic packaging technologies with respect to manufacturing methodologies, potential material development to address substantiated solution to practical food preservation and transportation problems.

CO2: Discuss the need, and to have the preparation for independent, life-long learning in the emerging areas of packaging technology in synergy with other technological applications.

CO3: Interpret and demonstrate as a professional, who has comprehensive knowledge on regulatory requirements for food packaging and allied areas to meet societal needs within realistic constraints such as economic, environmental, ethical, legal, cultural, health and safety, feasibility, and sustainability.

CO4: Examine and analyze problems associated with difficulties related to packaging material,

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

methodologies and food components to be packaged.

CO5: Communicate to defend effectively on professional activities in order to estimate and support societal awareness and need on packaging technology.

CO6: Create, develop and formulate appropriate packaging technologies with the aid of various tools with a view to work in real life situations and as independent entrepreneurs.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
2	Professional Elective– IV (Food quality management)	PE-AE 701 (C)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the importance of Quality specifications and quality attributes of different foods.
2. To know about the Food Safety Management System.

Pre-requisite:

1. Refrigeration & Air Conditioning
2. Heat and Mass Transfer
3. Engineering Thermodynamics & Heat Engines

Unit	Contents	Hrs./Unit
1	Definition of quality, Quality specifications and quality attributes of different foods, Statistical quality control, Quality control programs: History and development, Total quality management (TQM), Quality assurance, Management Principles, ISO 9000 Family (QMS), principles and requirements	12
2	Food Safety Management System ISO-22000 – Family, Key role, Principles of FSMS and requirements, HACCP- Prerequisites; GMP/C-GMP, GHP, GLP, Cleaning and Sanitation, Safety practices in the production areas, Pest Control, Withdrawal and Recall Procedures, traceability system, Principles and steps of HACCP Plan, Hazard Identification, Risk assessment, CCP Decision Tree, CAPA Plan, document and records,	12
3	Mandatory and voluntary regulations world-wide, CODEX, FDA, WHO, EFSA, WTO, (TBT, SPSs), GATT. Role of regulatory authorities in India - functioning, legal acts and their enforcements- FSSAI (in detail), BIS, AGMARK, Legal Metrology Act, Industry Specific Regulations, ASCI, EPA,	12

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	Export Quality Control and Inspection Act	
4	Certification, Certification procedures, Certifying bodies, Accrediting bodies, International bodies. GFSI benchmarking, FSSC 22000, BRC, SQF, IFS, FSMA, OSHA Auditing procedures- types of audit, Surveillance; Mock audit, third party quality certifying audit, Auditors and Lead auditors. Sampling procedure: tools and techniques, Bio-safety guidelines for research, environmental aspects of GMOs, handling and disposal of biowaste	9

Text and Reference Books:

Text Books

1. Total Quality Management, M.P. Poonia & S.C. Sharma, Khanna Publishing House (AICTE Recommended Textbook - 2018)
2. Total Quality Management, Poornima M. Charantimath, Pearson Education India
3. Total Quality Management for the Food Industries. WA Gould, Woodhead Publishing
4. Management and control of quality. James R Evans, William M Lindsey. Thomson South-western 5. Bioethics and Biosafety, M. K. Sateesh, I. K. International Pvt Ltd.

Reference Books

1. The Essentials of Quality Control Management, Peter N T Pang, Trafford publishing
2. Guide to Quality Management system for the food industry. Ralph Early

Course Outcome:

After completion of the course the students will be able to

CO1: Remember and relate principles of natural, biological science, and engineering fundamentals with basics food safety and quality management.

CO2: Understand the problems arising in quality control and quality assurance during food processing and interpret the tools and solutions that are being developed to solve such problems

CO3: Apply food safety management principles with an understanding of the limitations in application of the same in food quality and safety maintenance in a food industry.

CO4: Analyze existing food laws and quality management techniques in relation to follow legal limits and supply safe food to consumers.

CO5: Evaluate and interpret data and apply resources to reach a sustainable solution in food safety and quality management system in industries.

CO6: Develop system tools to meet specific needs of food safety and maintain the effective quality of food during processing taking into consideration public health and safety, cultural, societal and environmental issues.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
3	Professional Elective– V (Wasteland Development)	PE-AE 702 (A)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the importance of planning of wastelands development.
2. To know about the Sustainable wasteland development.

Pre-requisite:

1. Environmental science

Unit	Contents	Hrs./Unit
1	Land degradation – concept, classification - arid, semiarid, humid and sub-humid regions, denuded range land and marginal lands. Wastelands - factors causing, classification and mapping of wastelands, planning of wastelands development - constraints, agro-climatic conditions, development options, contingency plans. Conservation structures – gully stabilization, ravine rehabilitation, sand dune stabilization, water harvesting and recycling methods.	16
2	Afforestation - agro-horti-forestry silvipasture methods, forage and fuel crops - socioeconomic constraints. Shifting cultivation, optimal land use options. Wasteland development – hills, semi-arid, coastal areas, water scarce areas, reclamation of waterlogged and salt-affected lands.	14
3	Mine spoils- impact, land degradation and reclamation and rehabilitation, slope stabilization and mine environment management. Micro-irrigation in wastelands development.	7
4	Sustainable wasteland development - drought situations, socio-economic perspectives. Government policies. Participatory approach. Preparation of proposal for wasteland development and benefit-cost analysis.	8

Suggested Reading

Abrol, I.P., and V.V. Dhruvanarayana. 1998. Technologies for Wasteland Development. ICAR, New Delhi.

Ambast, S.K., S.K. Gupta and Gurcharan Singh (Eds.) 2007. Agricultural Land Drainage Reclamation of Waterlogged Saline Lands. Central Soil Salinity Research Institute, Karnal, Haryana.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Hridai Ram Yadav. 2013. Management of Wastelands. Concept Publishing Company. New Delhi.
Karthikeyan, C., K. Thangaraja, C. Cinthia Fernandez and K. Chandrakandon. 2009. Dryland Agriculture and Wasteland Management. Atlantic Publishers and Distributors Pvt. Ltd., New Delhi.
Rattan Lal and B.A. Stewart (Ed.). 2015. Soil Management of Smallholder Agriculture. Volume 21 of Advances in Soil Science. CRC Press, Taylor and Francis Group, Florida, USA.
Robert Malliva and Thomas Missimer. 2012. Arid Lands Water Evaluation and Management. Springer Heidelberg, New York.
Swaminathan, M.S. 2010. Science and Integrated Rural Development. Concept Publishing Company (P) Ltd., Delhi.
The Energy and Resources Institute. 2003. Looking Back to Think Ahead-Green India 2047. Growth with Resource Enhancement of Environment and Nature. New Delhi.
Virmani, S.M. (Ed.). 2010. Degraded and Wastelands of India: Status and Spatial Distribution. ICAR, New Delhi.

Course Outcome:

After completion of the course the students will be able to

- CO1:** Define land degradation and wasteland.
- CO2:** Understand conservation structures.
- CO3:** Illustrate water harvesting methods. .
- CO4:** Analyze the optimal land use options.
- CO5:** Evaluate micro-irrigation in wastelands development.
- CO6:** Develop Sustainable wasteland.

3	Professional Elective– V (Minor Irrigation and Command Area Development)	PE-AE 702 (B)	100	3	0	0	3
---	---	---------------------	-----	---	---	---	---

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the types of minor irrigation systems.
2. To know about the Command area development.

Pre-requisite:

1. Irrigation and drainage engineering

Unit	Contents	Hrs./Unit
1	Factors affecting performance of irrigation projects; types of minor irrigation systems in India; lift irrigation systems: feasibility, type of pumping stations and their site selection, design of lift irrigation systems; tank Irrigation: grouping of tanks, storage capacity, supply works and sluices;	16
2	Command area development (CAD)	14

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	programme components, need, scope, and development approaches, historical perspective,	
3	Command area development authorities- functions and responsibilities; on farm development works, reclamation works, use of remote sensing techniques for CAD works;	8
4	water productivity: concepts and measures for enhancing water productivity; Farmers' participation in command area development;	7

Suggested Reading

Arora, K.R. 2001. Irrigation, Water Power and Water Resources Engineering. Standard Publishers Distributors, Delhi.
Garg S. K. 2014. Irrigation Engineering and Hydraulic Structures, Khanna Publishers New Delhi.
Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing Vikas Publ. House New Delhi.
Sahasrabudhe SR. 2011. Irrigation Engineering and Hydraulic structures. SK Kataria & Sons Reprint 2015.

Course Outcome:

After completion of the course the students will be able to

CO1: Define minor irrigation.

CO2: Understand factors affecting performance of irrigation projects.

CO3: Illustrate command area development.

CO4: Analyze the use of remote sensing techniques for command area development.

CO5: Evaluate measures for enhancing water productivity.

CO6: Design the lift irrigation systems.

3	Professional Elective– V (Floods and Control Measures)	PE-AE 702 (C)	100	3	0	0	3
---	---	---------------------	-----	---	---	---	---

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the types of flood.
2. To know about the flood control measures.

Pre-requisite:

1. Soil and water conservation engineering

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Unit	Contents	Hrs./Unit
1	Floods- causes of occurrence, flood classification- probable maximum flood, standard project flood, design flood, flood estimation- methods of estimation; estimation of flood peak- rational method, empirical methods, unit hydrograph method. Statistics in hydrology, flood frequency methods- log normal, Gumbel's extreme value, log-Pearson type-III distribution; depth-area-duration analysis.	12
2	Flood forecasting. Flood routing- channel routing, Muskingum method, reservoir routing, modified Pul's method. Flood control history of flood control, structural and non-structural measures of flood control, storage and detention reservoirs, levees, channel improvement. Gully erosion and its control structures design and implementation. Ravine control measures. River training works, planning of flood control projects and their economics.	12
3	Earthen embankments- functions, classification- hydraulic fill and rolled fill dams- homogeneous, zoned and diaphragm type, foundation requirements, grouting, seepage through dams, flow net and its properties, seepage pressure, seepage line in composite earth embankments, drainage filters, piping and its causes.	12
4	Design and construction of earthen dam, stability of earthen embankments against failure by tension, overturning, sliding etc., stability of slopes- analysis of failure by different methods. Subsurface dams- site selection and constructional features. Check dam- Small earthen embankments- types and design criteria. Subsurface dams- site selection and constructional features.	9

Suggested Reading

Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.

Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.

Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.

Mutreja, K.N. 1990. Applied Hydrology. Tata McGraw-Hill Publishing Co., New York, Delhi.

Subramanya, K. 2008. Engineering Hydrology. 3rd Edition, Tata McGraw-Hill Publishing Co., New Delhi.

Bureau of Reclamation. 1987. Design of Small Dams. US Department of Interior, Washington DC, USA.

Arora, K.R. 2014. Soil Mechanics and Foundation Engineering (Geotechnical Engineering). Standard Publishers Distributors, Delhi.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Garg, S.K. 2014. Soil Mechanics and Foundation Engineering. Khanna Publishers Pvt. Ltd., New Delhi.
Stephens Tim. 2010. Manual on Small Earth Dams- A Guide to Siting, Design and Construction. Food and Agriculture Organization of the United Nations, Rome.

Course Outcome:

After completion of the course the students will be able to

CO1: Define flood.

CO2: Understand factors affecting flood.

CO3: Illustrate flood control measures.

CO4: Analyze flood forecasting.

CO5: Evaluate flood routing.

CO6: Design earthen dam.

4	Open Elective –III (Smart Agriculture)	OE-AE 701 (A)	100	3	0	0	3
---	--	---------------------	-----	---	---	---	---

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the application of artificial intelligence and IoT in agriculture.
2. To know about the sustainable agriculture.

Pre-requisite:

1. Agriculture for engineers

Unit	Contents	Hrs./Unit
1	Introduction and Types of Drones according to axis, Do's, Dont's and exploded view of Agri Drone, Components of Agri drone, Motor layout and Propeller direction.	8
2	RPAS Physical Checks and GCS tablet and RC Transmitter Health checks, Power-on Checks, Pre-flight Setup, Mission planning in the GCS, Flight modes and Mission Setup, Application of Drone in Agriculture, Hyperspectral Imaging.	9
3	Introduction to AI in Agriculture, AI Basics – The Role and Application of AI, Artificial Intelligence for Agriculture Innovation (AI-for-AI), AI Applications in Crop Management, Fundamentals of Machine Learning (ML), Machine Learning (ML) for Efficient Crop Management, Predictive Analytics – Crop Monitoring and Disease Detection Using AI, Precision Agriculture and Smart Irrigation Systems,	16

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	AI-enabled Crop Yield Prediction, AI-based Sustainable Agriculture , Sustainable Farming Practices and AI Integration, AI-driven Pest and Weed Management, Robotics and Automation in Farming , Robotics and Automation in Modern Agriculture, AI Algorithms Used in Robotics for Farm Operations, Autonomous Vehicles, Robotic Harvesting Systems, UAVs and AI for Crop Scouting and Monitoring in Agriculture.	
4	IoT Applications in AgTech , Smart Irrigation Systems, Livestock Monitoring, Environmental Sensors, Data Analytics and AI for Sustainable Agriculture , Data Collection and Management in AI Farming, Machine Learning for Soil Analysis and Fertilizer Optimization, Data Analysis for Optimizing Farm Operations, Potential Challenges and Limitations of AI in Agriculture, Future Directions and Opportunities in AI Farming.	12

Suggested Reading

Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.

Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.

Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.

Singh, R. and Gehlot, A. 2020. Artificial intelligence in agriculture: Fundamentals and applications. New India Publishing Agency – Nipa.

Course Outcome:

After completion of the course the students will be able to

CO1: Define smart agriculture.

CO2: Understand agri drone.

CO3: Illustrate artificial intelligence in agriculture.

CO4: Analyze robotics for farm operations.

CO5: Evaluate AI algorithms used in robotics for farm operations.

CO6: Design modern smart irrigation system.

4	Open Elective –III (Management of Canal Irrigation System)	OE-AE 701 (B)	100	3	0	0	3
---	--	---------------------	-----	---	---	---	---

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Objective:

1. To understand the purpose benefits and ill effects of irrigation.
2. To know about the relationship between duty, base period and delta.

Pre-requisite:

1. Irrigation and drainage engineering

Unit	Contents	Hrs./Unit
1	Purpose benefits and ill effects of irrigation; typical network of canal irrigation system and its different physical components; canal classification based on source of water, financial output, purpose, discharge and alignment; canal alignment: general considerations for alignment; performance indicators for canal irrigation system evaluation,	12
2	Estimation of water requirements for canal command areas and determination of canal capacity; water duty and delta, relationship between duty, base period and delta, factors affecting duty and method of improving duty; silt theory:	9
3	Kennedy's theory, design of channels by Kennedy's theory, Lacey's regime theory and basic regime equations, design of channels by Lacey's theory, maintenance of unlined irrigation canals, measurement of discharge in canals, rostering (canal running schedule) and warabandhi, necessity of canal lining: advantages and disadvantages,	12
4	types of canal lining and desirable characteristics for the suitability of lining materials; design of lined canals; functions of distributary head and cross regulators; canal falls, their necessity and factors affecting canal fall; sources of surplus water in canals and types of canal escapes; requirements of a good canal outlet and types of outlet	12

Suggested Reading

Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.

Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.

Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.

Course Outcome:

After completion of the course the students will be able to

CO1: Define canal irrigation system.

CO2: Understand typical network of canal irrigation system and its different physical components.

CO3: Illustrate types of canal lining and desirable characteristics for the suitability of lining materials.

CO4: Analyze relationship between duty, base period and delta.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

CO5: Evaluate water requirements for canal command areas.

CO6: Design channel.

4	Open Elective –III (Precision Farming Techniques for Protected Cultivation)	OE-AE 701 (C)	100	3	0	0	3
---	--	---------------------	-----	---	---	---	---

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the protected cultivation.
2. To know about the design and construction of green houses.

Pre-requisite:

1. Agriculture of engineers

Unit	Contents	Hrs./Unit
1	Protected cultivation: Introduction, History, origin, development, National and International Scenario, components of green house, perspective, Types of green houses, polyhouses /shed nets, Cladding materials, Plant environment interactions– principles of limiting factors, solar radiation and transpiration, greenhouse effect, light, temperature, relative humidity, carbon dioxide enrichment,	11
2	Design and construction of green houses– site selection, orientation, design, construction, design for ventilation requirement using exhaust fan system, selection of equipment, Greenhouse cooling system– necessity, methods– ventilation with roof and side ventilators, evaporative cooling, different shading material fogging, combined fogging and fan-pad cooling system, design of cooling system, maintenance of cooling and ventilation systems, pad care etc. Greenhouse heating necessity, components, methods, design of heating system. Root media– types– soil and soil less media, composition, estimation, preparation and disinfection, bed preparation.	14
3	Planting techniques in green house cultivation. Irrigation in greenhouse and net	11

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	house Water quality, types of irrigation system, components, design, installation and material requirement. Fogging system for greenhouses and net houses– introduction, benefits, design, installation and material requirement. Maintenance of irrigation and fogging systems. Fertilization– nutrient deficiency symptoms and functions of essential nutrient elements, principles of selection of proper application of fertilizers, fertilizer scheduling, rate of application of fertilizers, methods, automated fertilizer application.	
4	Greenhouse climate measurement, control and management. Insect and disease management in greenhouse and net houses Selection of crops for greenhouse cultivation, major crops in greenhouse irrigation requirement, fertilizer management, cultivation, harvesting and post harvest techniques; Economic analysis.	9

Suggested Reading

Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.

Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.

Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.

Course Outcome:

After completion of the course the students will be able to

CO1: Define protected cultivation.

CO2: Understand Plant environment interactions.

CO3: Illustrate Planting techniques in green house cultivation.

CO4: Analyze principles of selection of proper application of fertilizers.

CO5: Evaluate Irrigation in greenhouse.

CO6: Design greenhouse.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
5	Open Elective – IV (Remote Sensing and GIS Application)	OE-AE 702 (A)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the Basic component of remote sensing.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

- To know about the Basic classes of map projections and their properties.

Pre-requisite:

- Agriculture of engineers

Unit	Contents	Hrs./Unit
1	Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagnetic spectrum, energy interactions in the atmosphere and with the Earth's surface; major atmospheric windows; principal applications of different wavelength regions; typical spectral reflectance curve for vegetation, soil and water; spectral signatures; different types of sensors and platforms; contrast ratio and possible causes of low contrast; aerial photography; types of aerial photographs, scale of aerial photographs, planning aerial photography- end lap and side lap;	16
2	Stereoscopic vision, requirements of stereoscopic photographs; air-photo interpretation- interpretation elements; photogrammetry measurements on a single vertical aerial photograph, measurements on a stereo-pair vertical measurements by the parallax method; ground control for aerial photography; satellite remote sensing, multispectral scanner- whiskbroom and push-broom scanner; different types of resolutions; analysis of digital data- image restoration; image enhancement; information extraction,	14
3	Image classification, unsupervised classification, supervised classification, important consideration in the identification of training areas, vegetation indices; microwave remote sensing. GI Sand basic components, different sources of spatial data, basic spatial entities, major components of spatial data,	7
4	Basic classes of map projections and their properties, Methods of data input into GIS, Data editing, spatial data models and structures, Attribute data management, integrating data (map overlay) in GIS, Application of remote sensing and GIS for the management of land and water resources.	8

Suggested Reading

Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.

Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.

Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.

Course Outcome:

After completion of the course the students will be able to

CO1: Define Basic component of remote sensing.

CO2: Understand Image classification.

CO3: Illustrate satellite remote sensing.

CO4: Analyze unsupervised classification, supervised classification.

CO5: Evaluate vegetation indices.

CO6: Design map.

5	Open Elective – IV (Mechanics of Tillage and Traction)	OE-AE 702 (B)	100	3	0	0	3
---	--	---------------------	-----	---	---	---	---

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the Basic of mechanics of tillage tools.
2. To know about the traction and mechanics.

Pre-requisite:

1. Farm machinery and equipment

Unit	Contents	Hrs./Unit
1	Introduction to mechanics of tillage tools, engineering properties of soil, principles and concepts, stress strain relationship,	12
2	Design of tillage tools principles of soil cutting, design equation, force analysis, Modelling in soil dynamics and traction prediction equation.	12
3	Introduction to traction and mechanics, off road traction and mobility, traction model, traction improvement,	12
4	Tyre size, tyre lug geometry and their effects, tyre testing, soil compaction and application of computer in soil dynamics.	9

Suggested Reading

Vandenberg and Gill. Tillage and Traction.

Liljedahl JB and others. Tractor and Power Units.

Daniel Hill. Fundamentals of Soil Physics.

Terzaghi K & Peck Ralph B. Soil Mechanics in Engineering Practices.

Course Outcome:

After completion of the course the students will be able to

CO1: Define tillage tools.**CO2:** Understand engineering properties of soil.**CO3:** Illustrate Modelling in soil dynamics.**CO4:** Analyze off road traction and mobility.**CO5:** Evaluate traction prediction equation.**CO6:** Design tillage tools principles of soil cutting.

5	Open Elective – IV (Development of Processed Product)	OE-AE 702 (C)	100	3	0	0	3
---	---	---------------------	-----	---	---	---	---

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the Basic of Process design.
2. To know about the New product development.

Pre-requisite:

1. Heat and mass transfer

Unit	Contents	Hrs./Unit
1	Process design, Process flow chart with mass and energy balance, Unit operations and equipments for processing, New product development, Technology for value added products from cereal, pulses and oil seeds, Milling, puffing, flaking,	16
2	Roasting, Bakery products, snack food. Extruded products, oil extraction and refining, Technology for value added products from fruits, vegetables and spices,	14
3	Canned foods, Frozen foods, dried and fried foods, Fruit juices, Sauce, Sugar based confection, Candy,	7
4	Fermented food product, spice extracts, Technology for animal produce processing , meat, poultry, fish, egg products, Health food, Nutra-ceuticals and functional food, Organic food	8

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Text and reference books:

Text:

1. Geankoplis C. J. Transport processes and unit operations, Prentice Hall of India Pvt Ltd, New Delhi

Reference:

1. Earle, R.L. 2003. Unit Operations in Food Processing. Pergamon Press. Oxford. U.K.
2. Henderson, S.M., and Perry, R. L. Agricultural Process Engineering, Chapman and hall, London
3. McCabe, W.L., Smith J.C. and Harriott, P. Unit operations of Chemical Engineering. McGraw Hill.
4. Singh, R. Paul. And Heldman, R.Dennis. 2004. Introduction to Food Engineering. 3rd Edition. Academic Press, London.

Course Outcome:

After completion of the course the students will be able to

CO1: Define Process design.

CO2: Understand Process flow chart with mass and energy balance.

CO3: Illustrate Technology for value added products from cereal, pulses and oil seeds.

CO4: Analyze Unit operations.

CO5: Evaluate Technology for animal produce processing, meat, poultry, fish, egg products,.

CO6: Develop new product.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Practical:

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Dairy and Food Engineering Lab	PC-AE 791	100	0	0	2	1

Unit	Contents	No. of practicals
1	Study of pasteurizers, Study of sterilizers, Study of homogenizers, Study of separators, Study of butter churns, Study of evaporators,	4
2	Study of milk dryers, Study of freezers, Study of filtration, Design of food processing plants & preparation of layout,	5
3	Visit to multi-product dairy plant, Estimation of steam requirements,	3
4	Estimation of refrigeration requirements in dairy & food plant, Visit to Food industry.	3
Total		15

Suggested Reading

Ahmed, T. 1997. Dairy Plant Engineering and Management. 4th Ed. Kitab Mahal.
McCabe, W.L. and Smith, J. C. 1999. Unit Operations of Chemical Engineering. McGraw Hill.
Rao, D.G. Fundamentals of Food Engineering. PHI learning Pvt. Ltd. New Delhi.
Singh, R.P. & Heldman, D.R. 1993. Introduction to Food Engineering. Academic Press.
Toledo, R. T. 1997. Fundamentals of Food Process Engineering. CBS Publisher

Course Outcome:

After completion of the course the students will be able to understand the concept of

CO1: Memorize dairy development in India.

CO2: Discuss pasteurizers, sterilizers, homogenizers, separators, butter churns, evaporators,.

CO3: Illustrate the principles of milk dryers, freezers, filtration.

CO4: Analyze multi-product dairy plant.

CO5: Evaluate steam requirements.

CO6: Design food processing plants.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
2	Industrial Internship–II	SI-AE 781	100	0	2	0	2

Internship Project Scheme:

Each student will undertake project work assigned to him/her related to design/R&D /industrial problem solving in the area of agricultural engineering under the supervision of a faculty member or a group of faculty member(s) and/or industrial supervisor(s) within a agricultural industry/ allied industries/ testing laboratories/ research institutions/ academia. In principle, the design/development of the internship project work has to be carried out by a group of student(s)/an individual taking advice/guidance from respective supervisor(s) to address the specific problem identified. The internship project work will yield outcome based meaningful results, Scientific publication/ patents. Each student will submit a typed, hard-bound Final Internship Report for the work and its findings. Evaluation will include an oral presentation. Internship Project Dissertation should be carried out in presence of respective supervisor(s) and/ or faculty members and in presence of external examiner(s)/ Central Training & Placement Cell.

Brief Project Outline

1. Brief introduction, objectives & probable outcomes of the projects.
2. Literature survey/secondary search/market survey
3. Manufacturing/prototyping/designing process/products, optimization of processes and characterization through analytical techniques
4. Collection and analysis of data through statistical tools.
5. Conclusion of the project and report preparation
6. Internship Project Dissertation

Course Outcomes:

After completion of the course the students will be able to

CO1: Grasp on engineering principles in the area of agricultural engineering and allied areas.

CO2: Gain knowledge and skills to apply these principles in real-time problem-solving in agricultural engineering and relevant fields.

CO3: Communicate verbally with professional organizations and scientific community with reasonable clarity on topics within agricultural engineering and allied areas.

CO4: Familiar with legislative aspects in India for application of problem solving skills and knowledge acquired in the program.

CO5: Correlate the skills and knowledge acquired over the degree program with a particular job function as a professional.

CO6: Understand the challenges with the exposure to professional responsibilities with appropriate level of accountability.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
3	Project Work and Presentation-I	PW-AE 781	100	-	-	-	4

Internship Project Scheme

Each student shall undertake project work assigned to him/her related to design/R&D /industrial problem solving in the area of food science and allied technologies under the supervision of a faculty member or a group of faculty member(s) and/or industrial supervisor(s) within a food processing industry/ biochemical industry/ allied industries/ testing laboratories/ research institutions/ academia. In principle, the design/development of the internship project work has to be carried out by a group of student(s)/an individual taking advice/guidance from respective supervisor(s) to address the specific problem identified. The work will be allotted at the beginning of the eighth semester specifying the different aspects to be carried out by the student. The internship project work shall yield outcome based meaningful results, Scientific publication/ patents. Each student shall submit a typed, hard-bound Final Internship Report for the work and its findings. Evaluation shall include an oral presentation followed by a brief viva-voce. Internship Project Dissertation Defense should be carried out in presence of respective supervisor(s) and/ or faculty members and in presence of external examiner(s)/ Central Training & Placement Cell.

Brief Project Outline

1. Brief introduction, objectives & probable outcomes of the projects

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

2. Literature survey/secondary search/market survey
 3. Manufacturing/prototyping/designing process/products, optimization of processes and characterization through analytical techniques
 4. Collection and analysis of data through statistical tools.
 5. Conclusion of the project and report preparation
- A viva will be conducted after submission of the report and presentation of a seminar
6. Internship Project Dissertation defense and viva-voce

Course Outcomes:

After completion of the course the students will be able to

CO1: Grasp on engineering principles in the area of food science, technology, and allied areas.

CO2: Gain knowledge and skills to apply these principles in real-time problem-solving in food technology and relevant fields.

CO3: Communicate verbally with professional organizations and scientific community with reasonable clarity on topics within food science, engineering, technology, and allied areas. **CO4:** Familiar with legislative aspects in India for application of problem solving skills and knowledge acquired in the program.

CO5: Correlate the skills and knowledge acquired over the degree program with a particular job function as a professional.

CO6: Understand the challenges with the exposure to professional responsibilities with appropriate level of accountability.

Curriculum Structure

SEMESTER-VIII

Theory							
Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Agricultural Extension Activities	PC-AE 801	100	3	0	0	3
2	Open Elective – V (System Engineering /Wind Power Technology and System/Photovoltaic Technology and System)	OE-AE 801 (A/B/C)	100	3	0	0	3
3	Nano-science and Technology in Agriculture	VAC-AE801	100	3	0	0	0
Total Marks: 200				Total Credit: 6			
Practical & Sessional							
1	Project Work and Presentation/Viva voce–II	PW-AE 881	100	-	-	-	4
2	Industrial Internship –III	SI-AE 881	100	0	0	6	3
Total Marks: 200				Total Credit: 7			
Total Credit							13(6+7)

Haldia Institute of Technology
(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)
Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)

Theory:

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Agricultural Extension Activities	PC-AE 801	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the importance of extension education in agriculture
2. To know about the different poverty alleviation programmes

Pre-requisite:

1. Agriculture for engineers

Unit	Contents	Hrs./Unit
1	Extension Education – Meaning, objectives, concepts, principles and philosophy, critical analysis of definitions – Extension Education as a Profession – Adult Education and Distance Education.	7
2	Pioneering Extension efforts and their implications in Indian Agricultural Extension – Analysis of Extension systems of ICAR and SAU – State Departments Extension system and NGOs – Role of Extension in Agricultural Institute.	8
3	Poverty Alleviation Programmes – SGSY, SGRY, PMGSY, DPAP, DDP, CAPART – Employment Generation Programmes – NREGP, Women Development Programmes – ICDS, MSY, RMK, Problems in Rural Development.	8
4	Current Approaches in Extension: Decentralised Decision Making, Bottom up Planning, Farming System Approach, Farming Situation Based Extension, Market – Led – Extension, Farm Field School, ATIC, Kisan Call Centres, NAIP.	7

Suggested Reading

1. Chandrakandan KM, Senthil Kumar & Swatilaxmi. PS. 2005. Extension Education What? And What Not? RBSA Publ.
2. Jalihal KA & Veerabhadraiah V. 2007. Fundamentals of Extension Education and Management in Extension. Concept Publ. Khan
3. PM. 2002. Textbook of Extension Education. Himalaya Publ
4. Ray GL. 2006. Extension Communication and Management. Kalyani Publ

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Course Outcome:

After completion of the course the students will be able to

CO1: Define the basic concept of extension education.

CO2: Discuss the principles and philosophy in extension education.

CO3: Illustrate the role of extension in Agricultural Institute.

CO4: Analyze the poverty alleviation programmes. .

CO5: Evaluate the current approaches in Extension.

CO6: Design Farming Situation Based Extension.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
2	Open Elective – V (System Engineering)	OE-AE 801 (A)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the System concepts
2. To know about the Computer as a tool in system analysis

Pre-requisite:

1. Programming for problem solving
2. Database Management System

Unit	Contents	Hrs./Unit
1	System concepts. Requirements for a Linear programming problems. Mathematical formulation of Linear Programming problems and its Graphical solution.	12
2	Response of systems. Computer as a tool in system analysis. Simplex method. Degeneracy and Duality in linear programming. Artificial variable techniques, Big M method and two phase methods.	12
3	Mathematical models of physical systems. Modeling of Agricultural Systems and operations. Cost analysis.	12
4	Transportation problems. Assignment problems. Waiting line problems. Project management by PERT/CPM. Resource scheduling.	9

Course Outcome:

After completion of the course the students will be able to

CO1: Define the System concepts.

CO2: Discuss the Linear programming.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

CO3: Illustrate the Computer as a tool in system analysis.

CO4: Analyze the Cost.

CO5: Evaluate the Simplex method.

CO6: Design Innovative Agricultural Systems.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
2	Open Elective – V (Wind Power Technology and System)	OE-AE 801 (B)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the importance of wind power
2. To know about the horizontal and vertical axis wind turbines

Pre-requisite:

1. Fundamentals of renewable energy sources

Unit	Contents	Hrs./Unit
1	<i>History:</i> early wind power, technical development, influence of society and science. <i>Winds:</i> physical background, energy content, variation in time and in space, geographical resource distribution, influence of terrain, measurement methods, statistical analysis. <i>Turbines:</i> free flow, principles of drag and lift, aerodynamics, design of turbine blades, horizontal and vertical axis wind turbines, Betz' and Glauert's turbine theories, the BEM method	12
2	<i>Mechanics:</i> static and dynamic loads (oscillations), rotor dynamics, solid mechanics, mechanical modelling, aero-elasticity. <i>Electric generation:</i> synchronous/asynchronous generators, winding/permanent magnetised generators, constant/variable speed, transformers, power electronics, power converters.	12
3	<i>Design:</i> horizontal and vertical axis wind turbines, blades, control mechanisms, drive train, tower, and nacelle, and foundation, choice of materials, manufacture, and adaptation to different climates. <i>Control:</i> control targets, system modelling, control strategies (pitch and stall regulation), hardware. <i>Systems:</i> wind power parks, transports, erection, grid connection,	12

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	operation, maintenance.	
4	<p><i>Economy:</i> financing, investment, costs during the life time of a wind turbine, value of wind energy, business and market overview.</p> <p><i>Society:</i> environmental issues, law, forms of government support, technical aspects of environment. Small scale wind power: technology, economy, paths of development</p>	9

Course Outcome:

After completion of the course the students will be able to

CO1: Define the basic concept of wind power.

CO2: Discuss the principles of horizontal and vertical axis wind turbines.

CO3: Illustrate the winding/ permanent magnetised generators.

CO4: Analyze power converters.

CO5: Evaluate aero-elasticity.

CO6: Design horizontal and vertical axis wind turbines.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
2	Open Elective – V (Photovoltaic Technology and System)	OE-AE 801 (A/B/C)	100	3	0	0	3

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the importance of Solar PV Technology
2. To know about the Application of Solar PV system

Pre-requisite:

1. Fundamentals of renewable energy sources

Unit	Contents	Hrs./Unit
1	Solar PV Technology: Advantages, Limitations, Current Status of PV technology, SWOT analysis of PV technology. Types of Solar Cell, Wafer based Silicon Cell, Thin film amorphous silicon cell Thin Cadmium Telluride (CdTe) Cell, Copper Indium Gallium	12
2	Selenide (CIGS) Cell, Thin film crystalline silicon solar cell. Solar Photo Voltaic Module: Solar cell, solar module, solar array, series & parallel connections of cell,	12

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	mismatch in cell, fill factor, effect of solar radiation and temperature on power output of module, I-V and power curve of module.	
3	Balance of Solar PV system: Introduction to batteries, battery classification, lead acid battery, Nicked Cadmium battery, comparison of batteries, battery parameters, Charge controller: types of charge controller, function of charge controller, PWM type, MPPT type charge controller, Converters: DC to DC converter and DC to AC type converter.	12
4	Application of Solar PV system. Solar home lighting system, solar lantern, solar fencing, solar street light, solar water pumping system, Roof top solar photovoltaic power plant and smart grid.	9

Suggested Reading

Rai GD. 1998. Non-conventional Sources of Energy. Khanna Pub.

Rathore N.S., Kurchania A.K., Panwar N.L. 2006. Renewable Energy: Theory & Practice, Himanshu Publications,.

Solanki C.S. 2011. Solar Photovoltaic: Fundamentals, Technologies and Applications, PHI Learning Private Ltd.

Meinel & Meinel. Applied Solar Energy.

Derrick, Francis and Bokalders, Solar Photo-voltaic Products.

Course Outcome:

After completion of the course the students will be able to

CO1: Define the basic concept of Solar PV Technology.

CO2: Discuss the Types of Solar Cell.

CO3: Illustrate the Selenide (CiGS) Cell.

CO4: Analyze the effect of solar radiation and temperature on power output of module, I-V and power curve of module.

CO5: Evaluate DC to DC converter and DC to AC type converter.

CO6: Design Solar home lighting system.

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
3	Nano-science and Technology in Agriculture	VAC-AE801	100	3	0	0	0

Examination Scheme:

Continuous Assessment: 30 marks

End Semester Exam: 70 marks

Objective:

1. To understand the Scope of nanotechnology
2. To know about the Application of nanotechnology in modern day agriculture practices

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Pre-requisite:

1. Agriculture for engineers

Unit	Contents	Hrs./Unit
1	Introduction: Definition, History, What makes nanoscale so different from other length scales, key examples of nanotechnology. Scope of nanotechnology, nanoscale in perspective. Physics of solid state: Structure & Bonding in solids. Synthesis of nanomaterials: General approaches (Top-down and Bottom-UP), Physical Methods, Chemical Methods, Biological Methods, hybrid methods.	14
2	Properties of nanomaterials: Mechanical, Structural, Thermal, Electrical & Optical properties. Characterization techniques of nanomaterials: Microscopy, Spectroscopy and Diffraction techniques	14
3	Application of nanotechnology in modern day agriculture practices, Application of nanotechnologies in animal production, Nanotechnology and shelf life of agricultural and food products, Nanotechnologies for water quality and availability.	12
4	Green nanotechnology and the role of good governance and policies for effective nanotechnology development, Case study.	5

Course Outcome:

After completion of the course the students will be able to

CO1: Define the basic concept of nanotechnology.

CO2: Discuss the Scope of nanotechnology.

CO3: Illustrate the Properties of nanomaterials.

CO4: Analyze the Characterization techniques of nanomaterials.

CO5: Evaluate Nanotechnologies for water quality and availability.

CO6: Develop Green nanotechnology.

Practicals

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Project Work and Presentation/Viva voce-II	PW-AE 881	100	-	-	-	4

Course Objectives:

- To develop the capacity of students in correlating theoretical knowledge in to practical systems either to perform creative works or to perform analysis and hence to suggest solutions to problems, pertaining to environmental engineering domain and bring up collaborative learning skills.
- To develop self-directed inquiry and life-long skills.
- To enhance the communication skills of the students by providing opportunities to discuss in groups and to present their observations, findings and report in formal reviews both in oral and written format.

Content:

Project work for B. Tech students has to be allotted to the student at the beginning of 7th semester an expected to be completed in the 8th semester. Each group of students will be required under the supervision of a faculty/ joint supervision of a faculty. The research work has to be carried out by the students themselves occasionally consulting his supervisor(s). Each group of student is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project work is included of identifying particular area of investigation, literature review, preliminary investigation, field excursion, conducting of experiments, numerical modeling to validate experimental data, interpretation of results and report writing. The course content of 'Project I' is Research topic determination and literature review and 'Project II' contain literature review and preliminary and primary investigation of the project work.

The report of the project work has to be submitted in typed and bound form 7 days before commencement of the 7th semester and 8th semester examination. Assessment would be made on the basis of the submitted report and the presentation & viva voce examination conducted by a board of examiners constituted by the Departmental Academic Committee.

Course Outcomes:

At the end of this course, students will be able to:

- CO1:** Grasp on engineering principles in the area of agricultural engineering and allied areas.
- CO2:** Gain knowledge and skills to apply these principles in real-time problem-solving in agricultural engineering and relevant fields.
- CO3:** Communicate verbally with professional organizations and scientific community with reasonable clarity on topics within agricultural engineering and allied areas.
- CO4:** Familiar with legislative aspects in India for application of problem solving skills and knowledge acquired in the program.
- CO5:** Correlate the skills and knowledge acquired over the degree program with a particular job function as a professional.
- CO 6:** Combine the project report and presentation

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Sl. No.	Paper Name	Paper Code	Marks	L	T	P	Credit
2	Industry Internship Project	PW-AE 881	100	-	-	-	10

Internship Project Scheme:

Each student will undertake project work assigned to him/her related to design/R&D /industrial problem solving in the area of agricultural engineering under the supervision of a faculty member or a group of faculty member(s) and/or industrial supervisor(s) within a agricultural industry/ allied industries/ testing laboratories/ research institutions/ academia. In principle, the design/development of the internship project work has to be carried out by a group of student(s)/an individual taking advice/guidance from respective supervisor(s) to address the specific problem identified. The work will be allotted at the beginning of the eighth semester specifying the different aspects to be carried out by the student. The internship project work will yield outcome based meaningful results, Scientific publication/ patents. Each student will submit a typed, hard-bound Final Internship Report for the work and its findings. Evaluation will include an oral presentation followed by a brief viva-voce. Internship Project Dissertation Defense should be carried out in presence of respective supervisor(s) and/ or faculty members and in presence of external examiner(s)/ Central Training & Placement Cell.

Brief Project Outline

1. Brief introduction, objectives & probable outcomes of the projects.
2. Literature survey/secondary search/market survey
3. Manufacturing/prototyping/designing process/products, optimization of processes and characterization through analytical techniques
4. Collection and analysis of data through statistical tools.
5. Conclusion of the project and report preparation
6. Internship Project Dissertation defense and viva-voce

Course Outcomes:

After completion of the course the students will be able to

CO1: Grasp on engineering principles in the area of agricultural engineering and allied areas.

CO2: Gain knowledge and skills to apply these principles in real-time problem-solving in agricultural engineering and relevant fields.

CO3: Communicate verbally with professional organizations and scientific community with reasonable clarity on topics within agricultural engineering and allied areas.

CO4: Familiar with legislative aspects in India for application of problem solving skills and knowledge acquired in the program.

CO5: Correlate the skills and knowledge acquired over the degree program with a particular job function as a professional.

CO6: Understand the challenges with the exposure to professional responsibilities with appropriate level of accountability.

Annexure-I

Mandatory Additional Requirement (MAR) for earning B.Tech Degree

The additional requirement of MAR points applies to - every student, who is admitted to the 4 years B.Tech program under Autonomy, as per following:

Level of Entry in B.Tech Course	Total duration for earning Points	Minimum Points
1 st Year from the academic year 2020-21 onwards	1 st to 4 th Year	100
2 nd Year from the academic year 2020-21 onwards (Lateral Entry)	2 nd to 4 th Year	75

These points must be earned on the basis of active participation in co-curricular and extracurricular activities spanning through all the semesters of study. Every student may choose, as per his/her liking, activities in order to achieve the mandatory points (as per Table- I, depending on his/her entry level), before becoming eligible for award of the Degree. These activities can be spread over the years, as per convenience of the student.

Notes:

- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before *her* she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary
- Proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester.
- The college will form a 3 members committee and finalize the Activity Points for each
- student before entering them into the Online Point Entry System of the Institute
- Every student has to earn at least 100 / 75 (for lateral) activity points. The points students has earned will be reflected in the student's mark sheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Table I provides a List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.

Table-I

Sl.No.	Name of the Activity	Points	Maximum Points Allowed
1	MOOCS(SWAYAM/NPTEL/Spoken Tutorial)(per course)	20	40
2	TechFest/Teachers Day/Fresher's Welcome		
	Organizer	5	10
	Participants	3	6
5	Rural Reporting	5	10
6	Tree Plantation(per tree)	1	10
7	Participation in Relief Camps	20	40
8	Participation in Debate/Group Discussion/Tech quiz	10	20
9	Publication of Wall magazine in institutional level (magazine/article/internet)	10	20
10	Publication in News Paper, Magazine & Blogs	10	20
11	Research Publication(per publication)	15	30
12	Innovative Projects(other than course curriculum)	30	60
13	Blood donation	8	16
	Blood donation camp Organization	10	20
15	Participation in Sports/Games		
	College level	5	10
	University Level	10	20
	District Level	12	24
	State Level	15	30
	National/International Level	20	20
21	Cultural Programme(Dance, Drama, Elocution, Music etc.)	10	20
22	Member of Professional Society	10	20
23	Student Chapter	10	20
24	Relevant Industry Visit & Report	10	20
25	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10
26	Participation in Yoga Camp(Certificate to be submitted)	5	10
27	Self-Entrepreneurship Programme	20	20
28	Adventure Sports with Certification	10	20
29	Training to underprivileged/Physically challenged	15	30
30	Community Service & Allied Activities	10	20

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

Annexure-II

MOOCs List for B.Tech (Hons) 1st Yr

(Credit based courses are only opt by students from this bucket, which may change time to time as on the basis of availability of online courses)

Module	Course	Provider	Duration (Weeks)	Credits
Ethics	Ethics in Engineering Practice	NPTEL	8	2
	Ethics and Law in Data and Analytics	edX	6	1
	A Life of Happiness and Fulfilment	Coursera	6	1
	Introduction to Philosophy	Coursera	5	1
	Ethical Leadership Through Giving Voice	Coursera	4	1
Soft Skills	Enhancing Soft Skills and Personality	NPTEL	8	2
	Soft Skill Development	NPTEL	8	2
	Psychology at Work	Coursera	6	2
	Communication in the 21st Century Workplace	Coursera	4	1
	Successful Career Development	Coursera	7	2
	Working in Teams: A Practical Guide	edX	4	1
	Communication theory: bridging academia and practice	Coursera	9	3
	Write Professional Emails in English	Coursera	5	2
	Effective Writing	NPTEL	4	1
	Technical Writing	Coursera	5	2
	Interpersonal Communication for Engineering Leaders	Coursera	4	1
	Enhancing Soft Skill and Personality	NPTEL	8	2
	Employment Communication A Lab based course	NPTEL	8	2
	Speaking Effectively	NPTEL	8	2
	English Language for Competitive Exams	NPTEL	12	3
	Listening skills- the ultimate work place soft skills	Udemy	29hrs	2
	Soft skills: the 11 essential career soft skills	Udemy	31.5hrs	3
Programming Skills	Introduction to Programming with MATLAB	Coursera	9	3
	Introduction to Computer Science and Programming Using Python	edX	9	3
	Introduction to R for Data Science	edX	4	1
	Java Programming: Solving Problems with Software	Coursera	4	1
	Responsive Website Basics: Code with HTML, CSS, and JavaScript	Coursera	4	1
	Joy of computing using Python	NPTEL	12	3
	Programming, Data Structures and Algorithm Using Python	NPTEL	8	2
	Web Design for Everybody (Basics of Web Development and Coding) Specialization	Coursera	15	4
	An introduction to programming through C++	NPTEL	12	3
	Data Science with Python Course	Simplilearn	12	3
	Python training	Simplilearn	12	3
	Data science with R programming	Simplilearn	12	3
	Complete Python Bootcamp From Zero to Hero in Python	Udemy	22hrs	2
Learn python programming master class	Udemy	64.5hrs	4	

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

**Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)****MOOCS list for B.Tech (Hons), 2nd to 4th Year****(Credit based courses are only opt by students from this bucket, which may change time to time as on the basis of availability of online courses)**

Sl. No.	Course Name	Durati on (weeks)	Credit	Name of the MOOCs website	Availability
1	Organic Farming For Sustainable Agricultural Production	8	2	NPTEL	Active
2	Fundamentals of Food Process Engineering	12	3	NPTEL	Active
3	Micro Irrigation Engineering	12	3	NPTEL	Active
4	Advanced Aquaculture Technology	12	3	NPTEL	Active
5	Farm Machinery	12	3	NPTEL	Active
6	Soil Fertility And Fertilizers	12	3	NPTEL	Active
7	Thermal Operations In Food Process Engineering: Theory And Applications	12	3	NPTEL	Active
8	Natural Resources Management	12	3	NPTEL	Active
9	Post Harvest Operations And Processing Of Fruits, Vegetables, Spices And Plantation Crop Products	12	3	NPTEL	Active
10	Irrigation and Drainage	12	3	NPTEL	Active
11	Dairy and Food Process and Products	12	3	NPTEL	Active

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

**Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)**

	Technology				
12	Food Oils and Fats : Chemistry and Technology	12	3	NPTEL	Active
13	Wastewater Treatment and Recycling	12	3	NPTEL	Active
14	Strength Of Materials - IITKGP	12	3	NPTEL	Active
15	Fluid Mechanics	12	3	NPTEL	Active
16	Remote Sensing And GIS	8	2	NPTEL	Active
17	Data Base Management System	8	2	NPTEL	Active
18	Introduction To Internet Of Things	12	3	NPTEL	Active
19	Introduction To Machine Learning	12	3	NPTEL	Active
20	Solar Energy Engineering And Technology	12	3	NPTEL	Active
21	Fundamentals Of Artificial Intelligence	12	3	NPTEL	Active
22	Numerical Methods For Engineers	12	3	NPTEL	Active
23	Probability And Statistics	12	3	NPTEL	Active
24	Partial Differential Equations	12	3	NPTEL	Active
25	Engineering Mathematics - I	12	3	NPTEL	Active
26	Sustainable Energy Technology	12	3	NPTEL	Active
27	Engineering Mechanics	12	3	NPTEL	Active
28	E-Business	12	3	NPTEL	Active
29	Nanotechnology, Science	8	2	NPTEL	Active

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

**Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)**

	And Applications				
30	Ethics In Engineering Practice	8	2	NPTEL	Active
31	Cooling Technology: Why and How utilized in Food Processing and allied Industries	12	3	NPTEL	Active
32	Machine Learning For Soil And Crop Management	12	3	NPTEL	Active
33	Novel Technologies For Food Processing And Shelf Life Extension	12	3	NPTEL	Active
34	Traction Engineering	8	2	NPTEL	Active
35	Watershed Hydrology	12	3	NPTEL	Active
36	Water Quality Management Practices	12	3	NPTEL	Active
37	Modern Food Packaging Technologies: Regulatory Aspects and Global Trends	12	3	NPTEL	Active
38	Basics of Crop Breeding and Plant Biotechnology	12	3	NPTEL	Active
39	Engineering Hydrology	12	3	NPTEL	Active
40	Hydraulic Engineering	12	3	NPTEL	Active
41	Plastic Waste Management	8	2	NPTEL	Active
42	Surface Water Hydrology	12	3	NPTEL	Active

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

**Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)**

43	Water and waste water treatment	12	3	NPTEL	Active
44	Remote Sensing and GIS for rural development	12	3	NPTEL	Active
45	Natural Hazards	8	2	NPTEL	Active
46	Air pollution and Control	12	3	NPTEL	Active
47	Blockchain and its Applications	12	3	NPTEL	Active
48	Data Analytics with Python	12	3	NPTEL	Active
49	Research Methodology	8	2	NPTEL	Active
50	Rural Water Resources Management	12	3	NPTEL	Active
51	Intellectual Property	12	3	NPTEL	Active
52	IP Management & Technology Transfer	8	2	NPTEL	Active
53	Engineering Mathematics II	12	3	NPTEL	Active
54	Soft Skill Development	8	2	NPTEL	Active
55	Patent Drafting for Beginners	4	1	NPTEL	Active
56	Energy Resources, Economics and Environment	12	3	NPTEL	Active
57	Experimental Robotics	4	1	NPTEL	Active
58	Sensors and Actuators	12	3	NPTEL	Active
59	A brief introduction of Micro - Sensors	4	1	NPTEL	Active
60	Introduction To Soft	8	2	NPTEL	Active

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

**Syllabus for B. Tech in Agricultural Engineering
(Applicable from the academic session 2023-2024)**

	Computing				
61	Programming, Data Structures And Algorithms Using Python	8	2	NPTEL	Active
62	Process Equipment Design	12	3	NPTEL	Active
63	Waste to Energy Conversion	8	2	NPTEL	Active
64	Biological process design for wastewater treatment	8	2	NPTEL	Active
65	Matlab Programming for Numerical Computation	12	3	NPTEL	Active
66	Industrial Wastewater Treatment	12	3	NPTEL	Active
67	Biostatistics and Design of experiments	8	2	NPTEL	Active
68	Forests and their Management	12	3	NPTEL	Active
69	Municipal Solid Waste Management	12	3	NPTEL	Active
70	River Engineering	8	2	NPTEL	Active
71	Water Economics And Governance	12	3	NPTEL	Active
72	Environmental Modeling And Simulation	12	3	NPTEL	Active
73	Design, Technology And Innovation	8	2	NPTEL	Active
74	Fundamentals Of Artificial Intelligence	12	3	NPTEL	Active
75	Science,	12	3	NPTEL	Active

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

	Technology And Society				
76	Heat Exchangers: Fundamentals And Design Analysis	12	3	NPTEL	Active
77	Fundamentals Of Manufacturing Processes	12	3	NPTEL	Active
78	Strength Of Materials - IITM	12	3	NPTEL	Active
79	Customer Relationship Management	8	2	NPTEL	Active
80	Industrial Safety Engineering	12	3	NPTEL	Active
81	Nutrition and Health: Food Safety	8	2	Edx	https://www.edx.org/learn/nutrition/wageningen-university-research-nutrition-and-health-food-safety
82	Sustainable Agri-food Marketing	8	2	Edx	https://www.edx.org/learn/agriculture/dane-university-sustainable-agri-food-marketing
83	Sustainable Food Security: Food Access	6	2	Edx	https://www.edx.org/learn/sustainability/wageningen-university-research-sustainable-food-security-food-access
84	Sustainable Food Security: The value of systems thinking	6	2	Edx	https://www.edx.org/learn/sustainability/wageningen-university-research-sustainable-food-security-the-value-of-systems-thinking
85	Drones for agriculture: Advanced Sensing and Analysis	6	2	Edx	https://www.edx.org/learn/drones/wageningen-university-research-drones-for-agriculture-advanced-sensing-and-analysis
86	Unmanned Aerial Systems (UAS): Fundamentals	4	1	Edx	https://www.edx.org/learn/science/university-of-alaska-fairbanks-unmanned-aerial-systems-uas-fundamentals
87	Big data for Agri-Food: Principles and Tools	6	2	Edx	https://www.edx.org/learn/big-data/wageningen-university-research-big-data-for-agri-food-principles-and-tools
88	Food for Thought	10	3	Edx	https://www.edx.org/learn/food-science/mcgill-food-for-thought

Haldia Institute of Technology

(An Autonomous Institution Under Maulana Abul Kalam Azad University of Technology, West Bengal)

Syllabus for B. Tech in Agricultural Engineering (Applicable from the academic session 2023-2024)

89	R Programming Language for Statistical Computing and Graphical Representation	6	2	Udemy	https://www.udemy.com/course/r-programming-language/
90	90 days data science boot camp: Build portfolio of 90 projects	16	4	Udemy	https://www.udemy.com/course/learn-python-programming-for-beginners/
91	Data Science for Engineers	8	2	NPTEL	Active

Annexure-III

Guidelines regarding Mandatory Induction Program for the new students

Engineering education has evolved globally in a continuous manner to address the twin needs of industry and society. It is now an accepted fact that the institutions imparting technical education should aspire to create manpower who will possess strong technical knowledge and skill, have leadership qualities and be a team player, capable of coming up with innovative solutions and be alive to societal and community concerns. The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighbourhood, society and people. This will allow them to evolve as well rounded individuals.

The following schedule is laid down by the Institute to implement the three week long Induction Programme:

Week 1	1 st Half	Day 1	Overall introduction of the new students to the Institution, its different Departments & Faculty Members
	2 nd Half	Day 1	a) Assignment of faculty mentors to the new students b) Assessment and allotment for mentoring by senior students preferably from the second year
	2 hrs	Day 2, 3, 4, 5	Lectures by eminent personalities on different areas such as a) Introduction to Engineering b) Various topics of science and technology c) Innovation and entrepreneurship d) Creative and performing arts (e) Social issues
	2 hrs	Day 2, 3, 4, 5	Participation in Games, Yoga, Meditation etc.
	2 hrs	Day 2, 3, 4, 5	Visit to the different Departments of the Institute
Week 2 (All Days)	2 hrs		Scheduled class lectures as per timetable.
	2 hrs		Students to be conducted through proficiency modules to be prepared by respective Colleges for ascertaining English skills & Computer knowledge of the students and to prepare a report on the same
	2 hrs		Participation in Games, Sports, Yoga, Creative arts etc.
Week 3	2 hrs		Scheduled class lectures as per timetable
		Day 1	Visit to neighborhood locations
		Day 2	Visit to natural spots in adjoining areas to understand the effect of nature on society
		Day 3	Visit to Science Museum/laboratories
		Day 4 Day 5	Visit to NGOs

Department of Agricultural Engineering Haldia Institute of Technology, Haldia

The agendas:

Agenda 1: Formation of the syllabus of B.Tech Agricultural Engineering.

Agenda 2: There is provision of Internship/Project work in 3rd and 4th year. A good number of Professional Electives (PE) and Open Electives (OE) are offered considering Multidisciplinary/interdisciplinary courses.



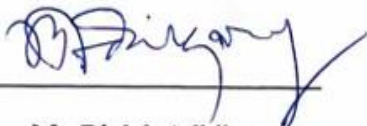
Prof. (Dr.) Madan kumar Jha
(BOS Member)



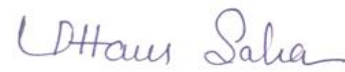
Dr. Alivia Chowdhury
(BOS Member)



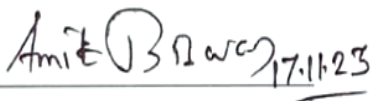
Dr. Sujit Hensh
(BOS Member)



Mr. Biplab Adhikary
(BOS Member)



Mr. Uttam Saha
(BOS Member)



Dr. Amit Biswas
(HOD)



Prof. (Dr.) Subrata Mondal
(Principal)

