

West Bengal State Council of Technical &
Vocational Education and Skill
Development
(Technical Education Division)



Syllabus
of

Diploma in Agricultural Engineering [AGR]

Part-III (6th Semester)

2023



**WEST BENGAL STATE COUNCIL OF TECHNICAL & VOCATIONAL
EDUCATION AND SKILL DEVELOPMENT**

(A Statutory Body under West Bengal Act XXVI of 2013)
(Technical Education Division)

Karigari Bhavan, 4th Floor, Plot No. B/7, Action Area-III, Newtown, Rajarhat, Kolkata-700 160

WBSCTVESD Curriculum for Diploma Courses in Engineering and Technology

Semester VI

(Agricultural Engineering)

SL NO	CATEGORY	SUBJECT	TYPE	SEM	L	PR	CONTACT HR PER WEEK	CREDIT	MARKS
1	AGPE4-601 OR AGPE4-602	Handling, Packaging and Storage of Agricultural Products OR Agricultural Waste Utilization	TH	6TH	2		2	2	100
2	OPEN ELECTIVE-II	Renewable Energy	TH	6TH	3		3	3	100
3	AGPC603	Farm Machinery & Equipments	TH	6th	3		3	3	100
4	OPEN ELECTIVE-I	Engineering economics and Project Management	TH	6th	3		3	3	100
5	AGHS604	Entrepreneurship and Start-ups	TH	6th	3		3	3	100
6	AGPC605	Water shed and hydrology	TH	6th	2		2	2	100
7	AGPC606	Renewable Energy Sources Lab.	PR	6th		2	2	1	100
8	AGPC607	Farm Machinery & Equipment Lab	PR	6th		4	4	2	100
9	AGPR608	Project work		6th		2	2	1	100
10	AGSE609	Seminar on project		6th		2	2	1	100
					16	10	26	21	1000

Syllabus for Handling Packaging and Storage of Agricultural Products (Theory)

Program Elective IV

Course Title	Handling Packaging and Storage of Agricultural Products
Course Code: AGPE4-601	Semester: Sixth
Duration: Seventeen Weeks	Maximum Marks 100
Teaching Scheme	Examination scheme
Theory: 2 hrs./week	Mid Semester Test: 20 Marks, Quizzes, Viva-voce, Assignment: 10 Marks
Total hours: 30	Class Attendance: 10 Marks
Credit 2	End Semester Exam.: 60 Marks
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

Aim:-

The aim of this course is to provide sound technical knowledge on various materials handling equipments, packaging systems and machineries, and storage systems & structures.

Objective :-

Knowledge of various types of handling, packaging, and storage systems is essentially required for processing and preservation of agricultural products. Hence this course is formulated to trend the students with the knowledge of theory, design and operation of various handling equipments, packaging and storage systems.

SL. NO.	TOPIC	Contact period
Unit 1	Material Handling Equipments	10
Unit 2	Packaging materials- selection, form and testing	10
Unit 3	Storage of grains	10
	TOTAL	30

Content: Theory (Handling, Packaging And Storage Of Agricultural Products)

2 hrs/wk

Handling, Packaging and Storage of Agricultural Products

1. Material Handling Equipments

Introduction to different conveying systems like belt conveyors, chain conveyors, screw conveyors, pneumatic conveyors, bucket elevators – their selection, operation.

2. Packaging Materials

Function of Packaging, Types of packaging, Selection of packaging materials, Packaging for different foods-Paper, plastic, glass, metals, Novel packaging, Vacuum packaging.

3. Storage of Grains

Changes in food grain during storage, Factors affecting losses in grain storage, Bag and Bulk Storage, Types of grain storage structure, Functional requirement of a storage structure, Design consideration in grain storage structure, Grain pressure theories

Text book:

1. Crosby, N.T.1981. Food packaging Materials Applied Science Publishers, London.
2. McFarlane Ian. 1983. Automatic control of food manufacturing processes. Applied Science Publishers, London.
3. Multon , J.L. 1989. Preservation and storage of grains, seeds and their by - products. CBS Publishers and Distributors, Delhi - 32.
4. Palling, S.J.(ed) 1980. Developments in Food Packaging. Applied Science Publishers Ltd., London.
5. Ripp, B. E. 1984. Controlled atmosphere and fumigation in grain storage. Elsevier Science Publishing Co.London.
6. Sacharow, S. and R.C.Grittin. 1980. Principles of food packaging. AVI Publishers Co., USA.
7. Shejbal, J. 1980. Controlled atmosphere storage of grains. Elsevier Scientific Publishing Co. London.
8. Wallace,B.Van Arsdel and Michael J. Copley. 1963. Food dehydration. The AVI Publishing Co.USA.

Syllabus for Agricultural Waste Utilization (Theory)

Program Elective IV

Course Title	Agricultural Waste Utilization
Course Code: AGPE4-602	Semester: Sixth
Duration: Seventeen Weeks	Maximum Marks 100
Teaching Scheme	Examination scheme
Theory: 2 hrs./week	Mid Semester Test: 20 Marks, Quizzes, Viva-voce, Assignment: 10 Marks
Total hours: 30	Class Attendance: 10 Marks
Credit 2	End Semester Exam.: 60 Marks
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

Aim:-

The basic aim is to trend the students for various recycling of the agricultural waste to maintain the natural balance while trapping the energy from them.

Objective :-

The utilization of Agricultural waste is equally important with a view.to make effective recycling. The efficient design of agricultural waste fired furnaces, briquetting process, equipment, power alcohol, utilization of wastes for paper production, particle board, by-products of rice husk, rice bran are some of the example which need to known to the students.

Content: Theory (Agricultural Waste Utilization) 2 hrs/wk

SL. NO.	TOPIC	Contact period
Unit 1	Source and availability of agricultural wastes and byproducts – types – solids & liquids – utilization pattern	3
Unit 2	Suitability of wastes as fuel – waste fired furnace – mechanism, construction and efficiency	3
Unit 3	Fuel briquettes – wastes suitable for briquetting – advantages of briquetting – process – types – machinery	3
Unit 4	Fuel briquetting – machinery – construction – working – factors affecting briquetting	4
Unit 5	Power alcohol – suitability of waste materials as raw materials –processes – acid hydrolysis, enzymatic hydrolysis and alkali hydrolysis	4
Unit 6	Production of power alcohol – fermentation, distillation, extractive distillation – effluent treatment in alcohol production	3
Unit 7	Paper board production – suitability of agricultural waste materials – unit operations – importance of proportion of waste and other chemicals for quality of paper boards	4
Unit 8	Testing of paper boards – quality aspects – tensile, tearing, bursting and water absorption characteristics	4

Unit 9	Production of particle boards – raw materials – processes – resins – types – unit operations – chipping, cleaning, mixing, hot pressing – equipments	2
Unit 10	Quality aspects – mechanical strength – water absorption and utility characters	2
		30

Text Book:

SI NO	Name of Book	Writer's Name	Publisher's Name
1	Rice: Production and Utilization	Luh(ed) S. Bor,	Oxford & IBH Publishing Co. Pvt LTD. New Delhi
2	Food, Feed and Fuel from Biomass	Chahal.D.S	Oxford & IBH Publishing Co. Pvt LTD. New Delhi
3	Biotechnology and other Alternative Technologies for Utilization of Biomass/ Agricultural Wastes	Chakraverty,A	Oxford and IBH Publishing Co. New Delhi
4	Post-harvest Technology of cereals and pulses	Chakraverty,A. and D.S.De.	Clarendon Press Oxford
5	Waste Management - Planning, Evaluation, Technologies	David C.Wilson	Ann Arbor Science Publishers,Inc. Michigan
6	Fuels from Biomass and wastes	Donald. L.Klass and Emert H. George	AACC, USA
7	Rice; Chemistry and Technology	Houston,D.F	Elsevier Applied Science Publishers. London
8	Energy Applications of Biomass	Michael.Z. Lowenstein	ICAR
9	Agro-Industrial Byproducts and nonconventional feeds for livestock feeding. Indian Council of Agricultural Research	Ranjhan,S.K	The Solvent Extractors Association of India ,Bombay
10	Hand Book on Rice Bran Processing and utilization of Products	Sheth B.M & B.V Metha	Jain Brothers. New Delhi
11	Biomass briquetting and Utilization	Srivastava P.K.,Maheswari R.C and Ohja T.P.	
12	Biomass Utilization	Wilfred. A. Cote	Plenum Press. New York

Syllabus for Renewable Energy (Theory)

Open Elective Course II

Course Title	Renewable Energy
Course Code:	Semester: Sixth
Duration: Seventeen Weeks	Maximum Marks 100
Teaching Scheme	Examination scheme
Theory: 3 hrs./week	Mid Semester Test: 20 Marks, Quizzes, Viva-voce, Assignment: 10 Marks
Total hours: 45	Class Attendance: 10 Marks
Credit 3	End Semester Exam.: 60 Marks
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

Syllabus as per council.

Syllabus for Farm Machinery and Equipments (Theory)

Course Title	Ground Water Wells and Pump
Course Code: AGPC603	Semester: Sixth
Duration: Seventeen Weeks	Maximum Marks 100
Teaching Scheme	Examination scheme
Theory: 3 hrs./week	Mid Semester Test: 20 Marks, Quizzes, Viva-voce, Assignment: 10 Marks
Total hours: 45	Class Attendance: 10 Marks
Credit 3	End Semester Exam.: 60 Marks
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

Aim:-

The aim of the subject is to develop the basic knowledge regarding use of agricultural machineries principle of operation, adjustment and maintenance of different agricultural machinery used at various stage of crop production.

Objective :-

This subject deals with the basic knowledge of agricultural machineries, their working principles and techniques for performance evaluation. The selection of suitable machineries for various uses in crop production is also dealt in this subject. The cost estimation for various uses of agricultural machineries is also taken care under this subject.

SL. NO.	TOPIC	Contact period
Unit 1	INTRODUCTION- Farm Mechanization	3
Unit 2	Tillage implements	8
Unit 3	Sowing and Interculture implements	7
Unit 4	Harvesting and Threshing Implements	8
Unit 5	Silage and Feed preparation	7
Unit 6	Land development and Miscellaneous equipments	6
Unit 7	Ergonomics	6
	TOTAL	45

Content: Theory (Farm Machinery & Equipments) 3 hrs/wk

INTRODUCTION- Farm Mechanization
 Status and scope of farm mechanization
 Tillage implements
 Machinery classifications; Primary and secondary tillage equipment
 2.1 Principles of construction, operation of primary and secondary implements

Sowing and Interculture implements
Sowing and planting equipments, Description, operation and calibration
Inter-cultivation tools, plant protection equipment,
Harvesting and Threshing Implements
Principle of crop harvesting and threshing
Crop harvesting tools
Crop threshing tools
Silage and Feed preparation
Chaff cutters and silage filling equipment
Land development and Miscellaneous equipments
land development machinery
special farm machines for sugarcane, cotton, potato, and horticultural crops operation
Ergonomics
Human engineering and safely in farm machinery.

Text book:

1. Farm Machines & Equipments; by: C.P.Nakra, Pub-Dhanpat Rai Publicatoin Pvt. Ltd.
2. 3917, Ganesh Building,Roshanpur,Nai Sarak,Delhi-6
3. Solved Problems in Agricultural Engineering; by:Radhey Lal & A.C.Dutta,
Pub-Saroj Prakasan, 64,Katra,Allahabad-2
4. Principles of Farm Machinery, by:Kepner, Bainer & Barger; Pub-The AVI Publishing Company,
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5. Elements of Farm Machinery; by A.C. Srivastava, Pub-Oxford & Ibh Publishing Co. Pvt. Ltd.
6. Principles of Agricultural Engineering, Vol.-I, by Michael A. M. & Ojha T. P.
7. Elements of Agricultural Engineering; by J. Sahay; Pub- Agro Book Agency, New Chitragupta
Nagar, Patna – 20

Syllabus for Engineering Economics and Project Management (Theory)

Open Elective I

Course Title	Engineering Economics and Project Management
Course Code:	Semester: Sixth
Duration: Seventeen Weeks	Maximum Marks 100
Teaching Scheme	Examination scheme
Theory: 3 hrs./week	Mid Semester Test: 20 Marks, Quizzes, Viva-voce, Assignment: 10 Marks
Total hours: 45	Class Attendance: 10 Marks
Credit 3	End Semester Exam.: 60 Marks
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

Syllabus as per council

Syllabus for Entrepreneurship and Start-ups (Theory)

Course Title	Entrepreneurship and Start-ups
Course Code: AGHS604	Semester: Sixth
Duration: Seventeen Weeks	Maximum Marks 100
Teaching Scheme	Examination scheme
Theory: 3 hrs./week	Mid Semester Test: 20 Marks, Quizzes, Viva-voce, Assignment: 10 Marks
Total hours: 45	Class Attendance: 10 Marks
Credit 3	End Semester Exam.: 60 Marks
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

Syllabus as per council

Syllabus for Watershed and Hydrology (Theory)

Course Title	Watershed and Hydrology
Course Code: AGPC605	Semester: Sixth
Duration: Seventeen Weeks	Maximum Marks 100
Teaching Scheme	Examination scheme
Theory: 2 hrs./week	Mid Semester Test: 20 Marks, Quizzes, Viva-voce, Assignment: 10 Marks
Total hours: 30	Class Attendance: 10 Marks
Credit 2	End Semester Exam.: 60 Marks
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

Aim:-

The course aim to make understand different components of hydrological cycle, different form of precipitation, evapo-transpiration, infiltration, porous and their estimation, run-off study, hydrograph, flood and draught.

Objective :-

This subject deals with the major natural resources specially water which is one of the important input to the crops. The knowledge of the subject will certainly help the students to learn hydrological cycles and efficient management with proper planning to save these scarce natural resources.

SL. NO.	TOPIC	Contact period
Unit 1	INTRODUCTION	2
Unit 2	PRECIPITATION	4
Unit 3	ABSTRACTIONS FROM PRECIPITATION	4
Unit 4	GEOMORPHOLOGY OF WATERDHD	3
Unit 5	RUNOFF	4
Unit 6	HYDROGRAPH	4
Unit 7	HEAD WATER FLOOD CONTROL	3
Unit 8	HYDROLOGY OF DRY LAND AREAS	3
Unit 9	INTRODUCTION TO WATERSHED MANAGEMENT AND PLANNING	3
	TOTAL	30

Content: Theory (Water Shed And Hydrology) 2 hrs/wk

INTRODUCTION:

Hydrologic cycle

PRECIPITATION:

Forms, rainfall measurement
Mass curve, hyetograph and mean rainfall depth
Frequency analysis of point rainfall, plotting position
Estimation of missing data
Test for consistency of rainfall records

ABSTRACTIONS FROM PRECIPITATION:

Interception
Infiltration
Evaporation and evapo-transpiration

GEOMORPHOLOGY OF WATERSHED:

Stream number, stream length, stream area, stream slope and Horton's laws

RUNOFF:

Affecting factors
Measurement of runoff; stage and velocity
Rating curve, extension of rating curve
Estimation of peak runoff rate and volume by rational method,
Cook's method, SCS method, Curve number method

HYDROGRAPH:

Components, base flow separation
Unit hydrograph theory
Unit hydrograph of different durations
Dimensionless unit hydrograph, distribution hydrograph
Synthetic unit hydrograph
Uses and limitations of unit hydrograph

HEAD WATER FLOOD CONTROL:

Methods, retards and their location
Flood routing - graphical methods of reservoir flood routing

HYDROLOGY OF DRY LAND AREAS:

Drought and its classification

9.0 INTRODUCTION TO WATERSHED MANAGEMENT AND PLANNING:

Text book:

1. Watershed Hydrology by R. Suresh, Standard Publishers Distributors.
2. Engineering Hydrology by K.Subramanya. Tata Mc Grow Hill Publishing Company.
3. Handbook of Applied Hydrology, by V.T.Chow. Mc Grow Hill, New York.
4. Hydrology & Water Resources Engineering, by S.K.Garg, Khanna Publishers Distributors

Syllabus for Renewable Energy Sources Lab

Course Title		Renewable Energy Sources Lab			
Course Code: AGPC606		Semester: Sixth			
Duration: Seventeen Weeks		Maximum Marks 100			
Teaching Scheme	Continuous Assessment-60			End Semester Assessment-40	
Practical: 2 hrs./week Total hours: 30	Assignments (to be allotted)	Class Performance	Class Attendance	Assignment on the day of Viva-voce	Viva-voce (Before Board of Examiners)
Credit 1	30	20	10	20	20
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.					

Aim:-

The aim of the subject is to develop basic concepts of different sources of non-conventional energy, their principles and application for human development.

Objective :-

The subject emphasizes different aspects of non-conventional energy sources like solar, wind, bio-gas, bio-fuel, etc. The study also includes various methods and devices used to transform the energy in accordance to the human need.

Content: Practical (Renewable Energy Sources Lab.) 2 hrs/wk

1. Demonstration of instruments and measurement of different type of radiation.
2. Study of solar radiation characterization,
3. Study and performance evaluation of a Box type solar cooker, Green house technology
4. Visit to domestic biogas plants
5. Visit to community biogas plant
6. Design of float type biogas plants for individual family/community.
7. Design of fixed dome type biogas plants for individual family/community.
8. Study of biogas characterization.
9. Study of design details of different types of gasifiers and their testing with agricultural residues as source of energy.
10. Constructional features of different types of windmills, their operations and maintenance.
11. Visit to community biogas plants, industrial application centers of solar energy, wind forms etc.
12. Design of wood chip based gasifiers.

Syllabus for Farm Machinery and Equipment (Lab)

Course Title		Farm Machinery and Equipment (Lab)			
Course Code: AGPC607		Semester: Sixth			
Duration: Seventeen Weeks		Maximum Marks 100			
Teaching Scheme	Continuous Assessment-60			End Semester Assessment-40	
Practical: 4 hrs./week Total hours: 60	Assignments (to be allotted)	Class Performance	Class Attendance	Assignment on the day of Viva-voce	Viva-voce (Before Board of Examiners)
Credit 2	30	20	10	20	20
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.					

Aim:-The aim of the subject is to develop the basic knowledge regarding use of agricultural machineries principle of operation, adjustment and maintenance of different agricultural machinery used at various stage of crop production.

Objective :-This subject deals with the basic knowledge of agricultural machineries, their working principles and techniques for performance evaluation. The selection of suitable machineries for various uses in crop production is also dealt in this subject. The cost estimation for various uses of agricultural machineries is also taken care under this subject.

Content: Practical (Farm Machinery & Equipment Lab.) 4 hrs/wk

1. Determination of draft of agricultural implements
2. Familiarization with farm machines and equipment
3. Study of constructional features of M.B. and disc ploughs and their adjustments
4. Study of different seed cum fertilizer drills and planters, their calibration and adjustments
5. Study of construction and operation of sprayers and dusters: their calibration and adjustments
6. Study of cultivators and weeders
7. Study of constructional details and adjustments of mowers and reapers
8. Study of constructional details, operation and adjustments of threshers, and their performance
9. Study of puddlers and cage wheels for rice cultivation
10. Study of nursery raising and paddy transplanter.
11. Study of special machines for potato and groundnut sowing and harvesting
12. Study of sugarcane equipment
13. Calculations on field capacities, field efficiencies and application rates of seed fertilizer and chemicals.