 HARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES																	
COURSE NAME : DIPLOMA IN AGRICULTURE ENGINEERING																	
COURSE CODE : AU																	
DURATION OF COURSE : 6 SEMESTERS										WITH EFFECT FROM 2012-13							
SEMESTER : SIXTH										DURATION : 16 WEEKS							
PATTERN : FULL TIME - SEMESTER										SCHEME : G							
SR. NO	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			PAPER HRS.	EXAMINATION SCHEME								SW (17600)	
				TH	TU	PR		TH (1)		PR (4)		OR (8)		TW (9)			
								Max	Min	Max	Min	Max	Min	Max	Min		
1	Drainage Engineering	DEG	17674	03	--	02	03	100	40	--	--	--	--	50@	20	50	
2	Food Processing and Preservation	FPP	17675	03	--	02	03	100	40	--	--	--	--	25@	10		
3	Alternate Energy Sources	ALS	17676	03	--	02	03	100	40	--	--	--	--	25@	10		
4	Protected Cultivation	PRC	17677	03	--	02	03	100	40	--	--	25#	10	25@	10		
5	Elective (Any One)																
	Energy Conservation and Audit	ECA	17678	03	--	02	03	100	40	--	--	--	--	25@	10		
	Extension Methods of Transfer of Technology	XMT	17679	03	--	02	03	100	40	--	--	--	--	25@	10		
	Seed Process Engineering	STP	17680	03	--	02	03	100	40	--	--	--	--	25@	10		
6	Operation, Maintenance & Testing of Farm Equipment	OMF	17810	--	--	02	--	--	--	50#	20	--	--	25@	10		
7	Project	PRO	17811	--	--	04	--	--	--	--	--	50#	20	50@	20		
TOTAL				15	--	16	--	500	--	50	--	75	--	225	--	50	

Student Contact Hours Per Week: **31 Hrs.**
THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.
Total Marks : **900**
@ - Internal Assessment, # - External Assessment, No Theory Examination, \$ - Common with Other Branches
Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work

- Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 50 marks as sessional work (SW).
- Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.
- Code number for TH, PR, OR, TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.

Course Name : Diploma in Agriculture Engineering

Course code : AU

Semester : Sixth

Subject Title : Drainage Engineering

Subject Code : 17674

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	--	50@	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

This subject is essential to equip the learner with the knowledge of drainage systems for agricultural lands and conservation of water for optimizing the agricultural production in the most efficient and economical ways. Problem of alkalinity and salinity affect the efficient drainage systems on farms and hence care has to be taken to minimize these. For effective drainage system it is essential to know about water table, Student must also know about basic designing aspects.

Objectives:

The students will be able to:

1. Identify the types of salt affected soils.
2. Know the causes of water logging and salt accumulation on the soil surfaces.
3. Understand the design procedures of surface and subsurface drainage systems.
4. Apply the drainage systems on the farms for safe removal of the excess water from the salt affected soils.

Theory:

Topic	Name of the topic and Contents	Hours	Marks
01	Basics of Drainage 1.1 Introduction and Definition. 1.2 Types of drainage methods. 1.3 Objectives of drainage. 1.4 Necessity of drainage. 1.5 Benefits of drainage. 1.6 Drainage problems of the state and country. 1.7 Drainage requirements of various crops. 1.8 Causes and effect of water logging. 1.9 Prevention and control of water logging.	06	12
02	Salt affected soils and their reclamation 2.1 Types of salt affected soils. 2.2 Chemical properties of soil. 2.3 Classification of salt affected soils. 2.4 Leaching requirements and methods. 2.5 Gypsum requirements. 2.6 Salt balance. 2.7 Numericals on leaching requirements.	06	12
03	Drainage investigation and requirements 3.1 Types of land requiring drainage. 3.2 Drainage properties (Structure, texture, Drainable porosity and Hydraulic conductivity). 3.3 Approach to the drainage problems. 3.4 Basic information required for investigating drainage problems. 3.5 Estimation of the drainage requirements. 3.6 Required water table depths. 3.7 Drainage depths for different crops. 3.8 Ground water contours and lowering of water tables. 3.9 Installations of Piezometer and observation wells.	10	20
04	Design of Surface Drainage system 4.1 Different types of surface drainage systems. 4.2 Land smoothing, leveling and grading. 4.3 Drainage coefficients. 4.4 Design considerations. 4.5 Hydraulic design of open channel (drain). 4.6 Drainage criteria for steady and unsteady state. 4.7 Economic aspects of surface drainage systems. 4.8 Numericals on above topics.	10	22
05	Design of Sub Surface Drainage system 5.1 Different types of sub surface drainage systems. 5.2 Components and layout of sub surface drainage systems. 5.3 Sub surface drainage materials (drainage pipes, drain envelop and drainage structures). 5.4 Design of gravel envelops. 5.5 Equation of drain spacing (Hooghoudt's equation). 5.6 Hydraulic design of sub surface drainage systems. 5.7 Installation of sub surface drainage systems. 5.8 Numericals on above topics.	14	30
06	Special methods of drainage	02	04

	6.1 Vertical drainage through bore wells. 6.2 Mole drains. 6.3 Drainage of irrigated lands in arid and semi arid areas.		
Total		48	100

Practical:**Intellectual skill:**

1. Know method of determination of various properties and coefficients of soil and water
2. Cost analysis of surface and sub-surface drainage systems
3. Report writing

Motor skills:

1. Ability measure quantities accurately
2. Use appropriate tools for designing
3. Determine chemical properties

List of Practicals:

1. Determination of chemical properties of soil and water (Ec, pH, ESP and SAR).
2. In situ measurement of hydraulic conductivity by single augur hole method.
3. In situ measurement of hydraulic conductivity by Inverse augur hole method.
4. Determination of drainage coefficients.
5. Installation of Piezometer and observation wells.
6. Preparation of iso bath and iso bar maps.
7. Determination of drainable porosity by sand tank model.
8. Determination of drainable porosity by using field methods.
9. Design of surface drainage system.
10. Design of sub surface systems.
11. Cost analysis of surface drainage systems.
12. Cost analysis of subsurface drainage systems.
13. Visit to sub surface drainage project.
14. Visit to drainage material manufacturing industries.

Learning Resources:**Books:**

Sr. No.	Title	Author	Publisher
01	Agricultural Drainage: Principles and Practices (1 st Edition)	U. S. Kadam, R. T. Thokal, S. D. Gorantiwar and A. G. Powar	Westville Publishing House, New Delhi.
02	Principles of Agricultural Engineering Vol. II (1 st Edition)	A. M. Michael and T. P. Ojha	Jain Brothers, Jodhpur
03	Drainage Engineering	J. N. Luthin	Wiley Eastern Pvt. Ltd. New Delhi.
04	Drainage Principles and Applications	-----	ILRI Publications, Netherlands Vol. 2
05	Drainage Principles and Applications	-----	ILRI Publications, Netherlands Vol. 4

Course Name : Diploma in Agriculture Engineering**Course Code : AU****Semester : Sixth****Subject Title : Food Processing and Preservation****Subject Code : 17675****Teaching and Examination Scheme**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	--	25@	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

Business of agriculture is not complete without the post harvest and value addition to raw agricultural commodities. The share of value addition and processing is not available to the farmers, So far only 1% of farm commodities are processed in India which needs further boost. The losses of perishable farm produce is also very high (30 to 40%) and require knowledge of preservation. This is also true when production is high and prices fall down. Processing and preservation methods not only help retain quality, flavour and nutritional value of the food item but also add to their values.

Objectives:**The student will be able to,**

- 1) Study importance and principle of food processing and preservation.
- 2) Know equipments and energy requirement of processing.
- 3) Study different methods of processing and preservation.
- 4) Study of causes of food spoilage.
- 5) Know chemicals for preservation of fruits and vegetables.

Theory:

Topic	Topic and Content	Hours	Marks
1	Introduction Importance of food process engineering Basic principles of food process engineering Unit operation in food process engineering Cleaning, screening, sorting, grading, peeling, size reduction, mixing, size enlargement, heat transfer, mechanical separations, mass transfer Unit processes in food process engineering	02	04
2	Material and Energy balance <ul style="list-style-type: none"> • Introduction • Basic principles of mass and energy balance • Material balance: Material balance calculations for various unit operations, Total mass and Composition Concentrations and ratios Material balances in screening Mixing Evaporation, Drying, Expression Recycling and bypass operations, Energy balance: Types of energy, Energy balance calculations for various unit operations Heat balance, heat balance problems involved in mixing, freezing and drying 	04	06
3	Heat Transfer and its applications Purpose of heat transfer Heat exchangers: Classification of heat exchanger (On the basis of fluid flow arrangement and on the basis of transfer of heat) Principle and working of <ul style="list-style-type: none"> • Industrial heat exchanger • Double pipe heat exchanger • Shell & tube heat exchanger • Plate type heat exchanger and 	04	06
4	Thermal Processing <ul style="list-style-type: none"> • Introduction • Classification of thermal processing Sterilization Pasteurization Blanching • Thermal process calculation • Novel thermal processing techniques Microwave heating • Non Thermal technologies High pressure processing 	04	06
5	Drying & Dehydration <ul style="list-style-type: none"> • Introduction • Purpose of drying • Basic drying theory • Heat requirements for vaporization • Heat transfer in drying • Dryer efficiencies 	04	06

	<ul style="list-style-type: none"> • Mass transfer in drying • Water activity 		
6	<p>Evaporation</p> <ul style="list-style-type: none"> • Introduction • Applications of evaporation • Components of an evaporator • Single effect evaporator • Multiple effect evaporator • Factors influencing evaporation process • Evaporation equipments <p>Batch pan/Open kettle evaporator Vertical type natural circulation evaporator Horizontal tube natural circulation evaporator Rising film evaporator Falling film evaporator Forced circulation evaporator Agitated film evaporator</p> <ul style="list-style-type: none"> • Material and energy balances in &Num. 	06	08
7	<p>Scope of Fruit & Vegetable Preservation in India</p> <ul style="list-style-type: none"> • Introduction • Scope • Scope of preservation • Product mix • Availability of raw material • Manpower • Capital • Lack of awareness • Marketing facilities • Transport facilities • Availability of containers • Publicity • Role of Government 	02	04
8	<p>Food Colours</p> <ul style="list-style-type: none"> • Introduction • Natural colouring matters <p>Chlorophylls Carotenoids Anthocyanins Flavonoids Anthoxanthins Tannins Quinines and xanthonenes Betalains</p> <ul style="list-style-type: none"> • Listing of Synthetic colours, Banned colours 	02	06
9	<p>Food Additives and Brominated Vegetable Oil</p> <ul style="list-style-type: none"> • Functions and uses of food additives • Classification of food additives • Brominated vegetable oils • Substances prohibited as additives in food • Additives to be used with caution 	02	06

10	Food Flavor <ul style="list-style-type: none"> • Flavour compounds: Flavonoids, Terpenoids, Sulphur compounds, Other volatile components • Types of flavor: Developed flavor, Processed flavor, Added flavor • Flavour additives 	02	06
11	Food Spoilage <ul style="list-style-type: none"> • Microbial spoilage: Bacteria, Yeasts and Moulds • Enzymatic spoilage • Spoilage by insect parasites and rodents • Characteristics and storage condition of food • Mechanical damage • Classification of food according to ease of spoilage 	02	04
12	Fermentation: Principle and Process of: <ul style="list-style-type: none"> • Acetic acid fermentation, Lactic acid fermentation, Alcoholic fermentation • Advantages and Disadvantages 	02	06
13	Principles & Methods of Preservations <ul style="list-style-type: none"> • Introduction • Principles of preservation • Modern methods of fruit & vegetable preservation: Physical methods, Chemical methods, By fermentation and By other methods 	04	10
14	Canning & Bottling of Fruits and Vegetables <ul style="list-style-type: none"> • Principle and process of canning • Containers for packing of canned products • Canning and bottling of fruits • Canning and bottling of vegetables • Specific requirements for canning of fruits and vegetables • General consideration in establishing a commercial fruit and vegetable cannery • Causes of spoilage of canned foods 	04	10
15	Freezing of Fruits and Vegetables <ul style="list-style-type: none"> • Methods of freezing: Sharp freezing, Quick freezing, Cryogenic freezing, Dehydrofreezing and Freeze drying: Concept, procedure and applications • Changes during freezing and storage • Thawing • Freezing process for fruits and vegetables 	02	08
16	Vinegar <ul style="list-style-type: none"> • Types of vinegar • Steps involved in vinegar production • Preparation of vinegar • Precautions • Problems in vinegar production 	02	04
Total		48	100

Practical:**Skills to be developed:****Intellectual Skills:**

1. Knowledge an importance of processing.
2. Methods of processing and preservation.
3. Equipments and machinery for processing.
4. Knowledge of preservative.

Motor Skills:

1. Preparation of dehydrated products.
2. Handling of process equipments.
3. Making of vegetable preservation products.
4. Making of fruit products.

List of Practical:

- Study of different types of dryers used in food industry.
- Study of different type of pasteurizers.
- Study of different preservation methods.
- Study of canning of fruits and vegetables.
- Study of jam, jelly, carbonated beverages, pickles, chutney and sauces
- Visit to food processing plant: Submission of visit report.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
1	Girdhari Lal G.S. Siddappa & G.L. Tandon	Preservation of Fruits & Vegetables	Indian council of agril. Research New Delhi 1100012
2	Akash Pare & B.L. Mandhyan	Food Process Engineering & Technology	New India Publishing agency, Pitam Pura, New Delhi 110088
3	R.P. Srivastava & Sanjeev Kumar	Fruits & Vegetable Preservation 3 rd revised & Enlarged Edition	International bool distribution company. Lucknow
4	Earle R.L.	Unit Operation in Food Processing	Pergamon Press, Oxford, New York

Course Name : Diploma in Agriculture Engineering

Course Code : AU

Semester : Sixth

Subject Title : Alternate Energy Sources

Subject Code : 17676

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	--	25@	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

Energy is an important aspect in all sectors of country's economy. The energy crisis is mainly caused due to increased population and enhanced standard of living and life style of people. The conventional sources of energy are insufficient to meet these demands. These are polluting the environment disturbing ecobalance. Hence, alternative energy sources are utilized for power production. The use of alternate energy sources is increasing day by day. Diploma engineers are expected to develop, operate and maintain these systems. It is therefore essential to know basics of energy conversion, conservation, and energy audit and waste heat recovery techniques.

Objectives:

The student will be able to,

1. Develop awareness for effective utilization of alternative energy sources.
2. Identify different components of solar energy and wind energy devices.
3. Identify and analyze biomass plant.
4. Identify and apply energy conservation techniques for commonly used power absorbing and generating devices.
5. Apply principles of energy conservation and energy management techniques.
6. Develop awareness about Energy Audits.

Theory:

Topic and Contents	Hours	Marks
Topic 1. Introduction to Energy Sources 1.1 Introduction. 1.2 Major sources of energy: Renewable and Non-renewable. 1.3 Primary and secondary energy sources. 1.4 Energy Scenario: <ul style="list-style-type: none"> • Prospects of alternate energy sources. • Need of Alternate energy sources. 	06	12
Topic 2. Solar Energy 2.1 Principle of conversion of solar energy into heat and electricity 2.2 Solar Radiation: Solar Radiations at earth's surface • Solar Radiation Geometry: Declination, hour angle, altitude angle, incident angle, zenith angle, solar azimuth angle 2.3 Applications of Solar energy: - <ul style="list-style-type: none"> • Construction and working of typical flat plate collector and solar concentrating collectors and their applications, • advantages and limitations • Space heating and cooling. • Photovoltaic electric conversion. • Solar distillation, Solar cooking and furnace. • Solar pumping and Green House. • Agriculture-Solar drying for foods • (no derivations and numerical) 	12	20
Topic 3. Bio-Mass 3.1 Biomass: Generation and utilization, Properties of biomass, Agriculture Crop & Forestry residues used as fuels, Combustion, Gasification, Biomass gasifiers and types etc. <ul style="list-style-type: none"> • Applications of Gasifiers to thermal power and Engines, Biomass as a decentralized power generation source for villages 3.2 Concept of Bio-energy: Bio-fuels, Biomass resources <ul style="list-style-type: none"> • Bio-Chemical Conversion: Aerobic and Anaerobic conversion, Fermentation etc. 3.3 Bio-fuels: Types of Bio-fuels, Production processes and technologies, Bio fuel applications, Ethanol as a fuel for I.C. engines, Relevance with Indian Economy.	06	14
Topic 4. Biomethanation 4.1 Importance of biogas technology, Different Types of Biogas Plants. Aerobic and anaerobic bioconversion processes. <ul style="list-style-type: none"> • Various substrates used to produce Biogas (cow dung, human and other agricultural waste, municipal waste etc.) • Individual and community biogas operated engines and their use. • Application of Biogas in domestic, industry and vehicles. 	05	10
Topic 5. Wind Energy 5.1 Wind Energy: Basics & Power Analysis, Wind resource assessment, 5.2 Wind Power estimation techniques, Principles of Aerodynamics of wind turbine blade, various aspects of wind turbine design. 5.3 Main considerations in selecting a site for wind mills. <ul style="list-style-type: none"> • Advantages and limitations of wind energy conversion. 5.4 Classification of wind mills <ul style="list-style-type: none"> • Construction and working of horizontal and vertical axis wind mills, 	06	16

their comparison • Main applications of wind energy for power generation and pumping.		
Topic 6. Geothermal Energy 6.1 Availability of Geothermal Energy-size and Distribution, Recovery of Geothermal Energy, Various Types of Systems to use Geothermal Energy. 6.2 Direct heat applications, Power Generation using Geothermal Heat	04	10
Topic 7. Other Sources of Renewable Energy 7.1 Hydrogen Energy Hydrogen as a renewable energy source, Sources of Hydrogen, Fuel for Vehicles. Hydrogen Production: Direct electrolysis of water, thermal decomposition of water, 7.2 Fuel Cell Fuel cell - Principle of working, construction and applications. 7.3 Hydel Energy Hydro power: Potential, Mini and Microhydel Power (MHP) Generation: Classification of hydel plants, Concept of micro hydel, merits, Status in India 7.4 Nuclear Energy Potential of Nuclear Energy, International Nuclear Energy Policies and Regulations. Nuclear Energy Technologies – Fuel enrichment, Nuclear Waste Disposal.	09	18
Total	48	100

Practical:**Skills to be developed;****Intellectual Skills:**

1. Identify concept, parts of devices and their functions.
2. Understand the construction and working principle of Renewable energy systems.
3. Know function, classification and discrimination of parts or equipments.

Motor Skills:

1. Ability to observe / locate / operate various parts of instruments / equipments / tools.
2. Ability to accurately measure the various parameters.
3. Ability to follow the systematic procedure.
4. Ability to handle data and draw graphs.

List of Practicals:

- 1) To collect information about global and Indian energy market.
- 2) To perform an experiment on solar flat plate collector used for water heating.
- 3) To study and analyze performance of Solar street lighting System.
- 4) To study construction and working of photo voltaic cell.
- 5) To study construction, working and maintenance of solar cooker.
- 6) Visit to plant of solar heating system for hotel/hostel/railway station etc.
- 7) To study construction and working of horizontal axis wind mill or to visit a nearest wind farm.
- 8) To visit a biomass/ biogas plant of municipal waste or else where.

Learning Resources:**1. Books:**

Sr. No.	Author	Title	Publisher
1	Dr B. H. Khan	Non conventional energy Resources	Tata McGraw Hill
2	G. D. Rai	Non conventional energy sources	Khanna publication
3	S. P. Sukhatme	Solar energy	Tata McGraw Hill
4	H. P. Garg	Solar energy	Tata McGraw Hill
5	Arrora Domkundwar	Power plant engineering	Dhanpat Rai & Co.

2. CDs, PPTs, Models, Charts etc. Websites:

1. CDs developed by National Power Training Institute, (Under the ministry of Power, Government of India) Opposite VNIT, South Ambazari road, Nagpur
2. Website of Bureau of Energy and Efficiency. (www.bee-india.nic.in)
3. Website for Akshay Urja News Bulletin. (www.mnes.nic.in)

Course Name : Diploma in Agriculture Engineering

Course Code : AU

Semester : Sixth

Subject Title : Protected Cultivation

Subject Code : 17677

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	25#	25@	150

NOTE:

- Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.
- Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).

Rationale:

Recent developments have clearly indicated that effect of environment like air pollution, uncertain weather conditions, and water scarcity is affecting the yield and quality of crops, fruits, vegetables, flowers etc. Therefore it has become necessary to use protected cultivation methods in farming. The student, therefore must understand the principles, theoretical aspects and developing skills in protected cultivation

This subject covers basics of protected farming which includes development of green houses, polyhouses and methods adopted for cultivation in such restricted conditions.

Objectives:

The student will be able to:

1. Understand plant response to Greenhouse environment
2. Plan and design of greenhouses
3. Select appropriate material for construction of greenhouse
4. Select crops to be cultivated under greenhouse

Theory:

Topic and Contents	Hours	Marks
Topic 1. Greenhouse Technology 1.1 History of green house, advantages of Green house, Greenhouse effect. 1.2 Greenhouse - World scenario, Indian situation: present and future. 1.3 Different agro - climatic zones in India. 1.4 Environmental factors and their effects on plant growth	04	08
Topic 2. Greenhouse Design 2.1 Basics of greenhouse design, different types of structures – glasshouse, shade net, poly tunnels. 2.2 Classification of Green houses on the basis of shape, construction, covering material (Glazing material). 2.3 Planning and design of greenhouse: Site selection and orientation, basics of structural design, covering materials. Construction materials (Wood, G.I., Aluminum, Steel, RCC, Glass). 2.4 Design and development of low cost greenhouse. 2.5 Energy Management	08	16
Topic 3. Growth Media 3.1 Introduction, principles, chemical properties 3.2 Properties of root media. 3.3 Soil culture, types of soil, 3.4 Drainage, Flooding And Leaching, 3.5 Soil pasteurization in moss / Coco pith and mixtures, 3.6 Rock Wool and other inert media.	08	16
Topic 4. Green House Environment 4.1 Interaction of light, temperature, humidity, CO ₂ , water on crop regulation 4.2 Greenhouse heating, cooling, ventilation and shading. 4.3 Types of ventilation- Forced cooling techniques - Glazing materials 4.4 Micro irrigation and Fertigation.	08	16
Topic 5. Greenhouse Heating and Cooling 5.1 Necessity of heating 5.2 Methods of controlling temperature in greenhouse 5.3 Equipment required for heating and controlling temperature. 5.4 Methods of Greenhouse Cooling : Ventilation, Ventilation with roof and side ventilators, 5.5 Roof shading, 5.6 Evaporative cooling (EC): (a) Fan and Pad system (b) High pressure mist system, (c) Low pressure mist system 5.7 Greenhouse Irrigation System:- Rules of watering, Hand Watering, Perimeter Watering, Overhead Sprinklers, Boom Watering, Drip Irrigation	14	28
Topic 6. Agricultural Structures 6.1 Farm stead:- Location, Types of farm stead (Dairy Barns, Stanchan Barns) 6.2 Poultry Houses: - Deep litter, Cage house, Brooder type. 6.3 Farm fencing 6.4 Water supply and sanitation of poultry houses and dairy barns	06	16
Total	48	100

List of Assignments:

1. Study of different types of greenhouses based on shape, construction and glazing materials.
2. Calculation of air rate exchange in an active summer cooling system.
3. Calculation of air rate exchange in an active winter cooling system.
4. Visit to commercial green houses.
5. Study of dairy barns and poultry houses.
6. Design of water supply system for ideal farm houses.

Learning Resources:**Books:**

Sr. No.	Author	Title	Year	Publisher
1	K. Radha Manohar C. Igathinathane	Green House Technology & Management,	First Edition -2000	B.S.Publications 4-4-309, Sultan Bazar, Hyderabad - 500 095
2	G.N.Tiwari, R.K.Goyal	Greenhouse Technology Fundamentals, Design, Modelling & Applications	First Edition -1998	Narosa Publishing House 6, Community Centre, Panchasheel Park, New Delhi-110 017
3	Vilas M. Salokhe and Ajay K. Sharma.	Greenhouse Technology and applications	First Edition (2006)	Agrotech publishing academy Udaipur (Raj.),
4	A. M. Michael	Principles of Agricultural Engineering Vol. II	First Edition	Jain Brothers New Delhi
5	B. P. Sawant J. M. Potekar, H. W. Awari	A Text Book of Greenhouse and Post Harvest Technology	1 st Edition June 2008	Nikita Publication, C/o: Narendra Book Depot, Mukund Tara Building, Old Cloth Line, Latur- 413512

Course Name : Diploma in Agriculture Engineering

Course Code : AU

Semester : Sixth

Subject Title : Energy Conservation and Audit

Subject Code : 17678

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	--	25@	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Seasonal Work (SW).**

Rationale:

Technological development in all sectors has caused imbalance in energy generation and its consumption. Energy conservation is a scientific tool provided to minimize the energy imbalance. This is one of the rapid emerging field in the area of electrical engineering hence this has been included as core technology subject.

The contents on energy conservation techniques in lighting systems, motors, transformers and transmission - distribution lines will be useful to reduce energy losses and wastage in residential, commercial and industrial sectors.

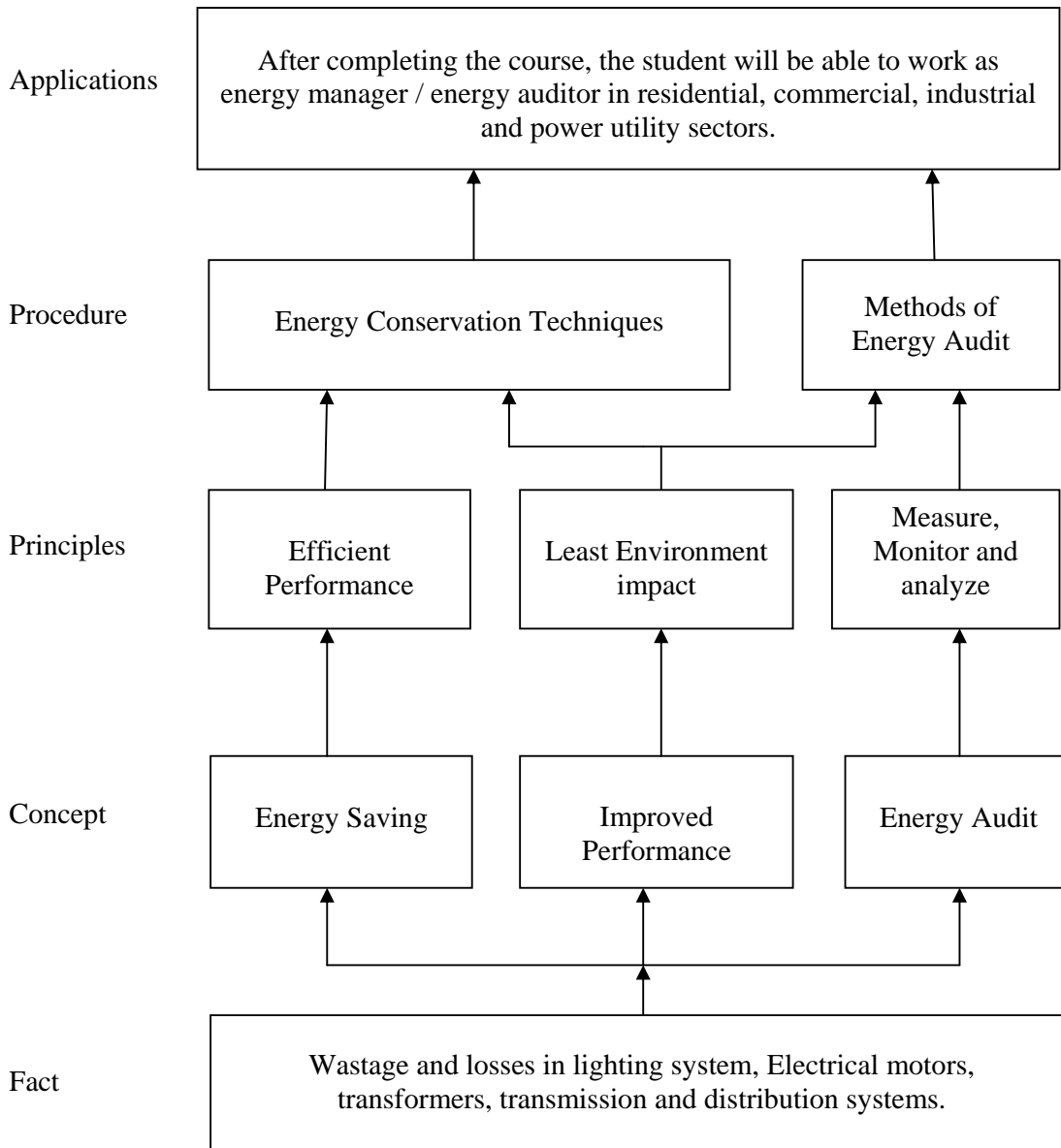
The topic on energy audit will be a useful tool to participate in energy conservation program of the nation.

General Objectives:

The students will be able to:

1. Identify the energy losses and wastage.
2. Suggest the energy conservation techniques in various sectors.
3. Find the opportunity for saving in energy consumption through tariff structure.
4. Prepare energy audit report.

Learning Structure:



Theory:

Topic and Contents	Hours	Marks
<p>Topic 1 : Energy Conservation</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Identify the need of Energy Conservation. ➤ State functions of Government organization working for ECA. <p>Contents:</p> <ol style="list-style-type: none"> 1.1 Preset energy scenario. 1.2 Need of energy conservation. 1.3 State the meaning of term Energy Conservation. 1.4 Energy Conservation Act – 2003. 1.5 Functions of Government Organization (NPC, MNRE, BEE, MEDA). 	02	04
<p>Topics 2: Energy Conservation in Lighting system</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Assess existing lighting system ➤ Identify energy conservation techniques in lighting system. ➤ Suggest methods to improve energy conservation <p>Contents:</p> <ol style="list-style-type: none"> 2.1 Basic terms used in Lighting system (Illumination). 2.2 Recommended Luminance levels 2.3 Procedure for assessing existing Lighting system in a facility. 2.4 Energy Conservation techniques in lighting system. <ul style="list-style-type: none"> • By replacing Lamp sources. • Using energy efficient luminaries. • Using light controlled gears. • By installation of separate transformer / servo stabilizer for lighting. • Periodic survey and adequate maintenance programs. • Energy Conservation techniques in fans, Electronic regulators. 	06	12
<p>Topic 3 : Energy Conservation techniques in Electrical Motors</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Select electrical motors for suitable application. ➤ Energy conservation techniques for improving the performance of motor by various methods. <p>Contents:</p> <ol style="list-style-type: none"> 3.1 Construction, Power flow and working of Induction motor. 3.2 Factors governing the selection of Induction motor. 3.3 Need for energy conservation in Induction motor. 3.4 Various energy conservation techniques in Induction motor. <ul style="list-style-type: none"> • By improving Power quality. • By motor survey. 	06	14

<ul style="list-style-type: none"> • By matching motor. • By minimizing the idle and <ul style="list-style-type: none"> ○ Redundant running of motor. • By operating in star mode. • By rewinding of motor. • By improving mechanical <ul style="list-style-type: none"> ○ Power and transmission ○ Efficiency. <p>3.5 Energy Efficient motors.</p> <ul style="list-style-type: none"> • Comparison with conventional Induction motor 		
<p>Topic 4: Energy Conservation techniques in transformer.</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ List out the methods to improve performance of transformer. ➤ Suggest energy conservation techniques to improve transformer performance <p>Contents:</p> <p>4.1 Need of energy conservation in transformer.</p> <p>4.2 Methods (related to material, design) to improve the performance of transformer.</p> <p>4.3 Energy conservation techniques related to transformer.</p> <ul style="list-style-type: none"> • Loading sharing • Parallel operation • Isolating techniques <p>4.4 Energy efficient transformers.</p> <ul style="list-style-type: none"> • Amorphous transformers • Epoxy Resin cast transformer (Dry type of transformer). • Periodic maintenance. 	04	08
<p>Topic 5 : Energy conservation in transmission and distribution system.</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State scenario of losses in transmission and distribution system ➤ Identify Energy conservation opportunities ➤ Suggest methods for energy conservation. <p>Contents:</p> <p>5.1 Scenario of transmission and distribution losses at state level, national level and at global level.</p> <p>5.2 Types of losses in transmission and distribution system (commercial and technical losses)</p> <p>5.3 Energy conservation techniques in transmission and distribution system related to technical losses.</p> <ul style="list-style-type: none"> • By reducing I^2R losses. • By compensating reactive power flow. • By optimizing distribution <ul style="list-style-type: none"> ○ voltage. • By balancing phase currents. • By using energy efficient <ul style="list-style-type: none"> ○ transformers. <p>5.4 Energy conservation techniques related to commercial losses.</p>	06	12

<p>Topic 6: Relation Between Tariff and Energy Conservation.</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Identify the opportunities to reduce energy bill through selection of tariff structure ➤ Select appropriate tariff structure to reduce energy bill <p>Contents:</p> <p>6.1 Types of tariff structure.</p> <p>6.2 Terms involved in tariff.</p> <p>6.3 Specific tariff:</p> <ul style="list-style-type: none"> • Time-off-day tariff • Peak-off-day tariff • Power factor tariff • Maximum Demand tariff • Load factor tariff <p>6.4 Application of tariff system to reduce energy bill.</p> <p>6.5 Simple numerical based on power factor and load factor tariff.</p>	06	14
<p>Topic 7 : Energy Conservation by Cogeneration</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Classify cogeneration systems. ➤ Selection of appropriate cogeneration system to reduce energy bill <p>Contents:</p> <p>7.1 What is cogeneration?</p> <p>7.2 Need for cogeneration.</p> <p>7.3 Classification of cogeneration system on the basis of sequence of energy use.</p> <ul style="list-style-type: none"> • Topping cycle • Bottoming cycle <p>7.4 Classification of cogeneration system on the basis of technology.</p> <ul style="list-style-type: none"> • Steam turbine cogeneration. • Gas turbine cogeneration • Reciprocating engine cogeneration. <p>7.5 Factors governing the selection of cogeneration system.</p> <p>7.6 Advantages of cogeneration.</p>	04	12
<p>Topic 8: Energy Conservation Equipment.</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ List out energy conservation equipments. ➤ Select proper energy conservation equipments in various applications. <p>Contents:</p> <p>8.1 What is energy conservation equipment?</p> <p>8.2 Energy conservation equipment related to Lighting system.</p> <ul style="list-style-type: none"> • Centralized Control Equipment (Microprocessor based). • Occupancy sensors/Motion Detectors. • Control gears: Dimmers, Regulators, and Stabilizers). <p>8.3 Energy conservation equipment related to electrical motors: Construction, working and advantages of each energy conservation Equipment listed below:</p> <ul style="list-style-type: none"> • Soft starter: For induction motors • Power Factor Controller • Static capacitor 	06	12

<ul style="list-style-type: none"> • Automatic star delta starter • Variable Frequency Drives. <p>8.4 Energy conservation equipments in T&D system: Working principle and operation of</p> <ul style="list-style-type: none"> • Maximum Demand Controller • KVAR Controller • Automatic Power Factor controller. 		
<p>Topic 9 : Energy Audit.</p> <p>Specific objectives:</p> <ul style="list-style-type: none"> ➤ Select energy audit instruments. ➤ Prepare/Develop questionnaire for energy audit. ➤ Apply ABC analysis in energy projects. ➤ Calculation of simple pay back period. ➤ Write energy audit report. <p>Contents:</p> <p>9.1 Energy flow diagrams and its significance.</p> <p>9.2 Energy audit instruments and their use.</p> <p>9.3 Prepare questionnaire for energy audit projects.</p> <p>9.4 ABC analysis and it's advantages referred to energy audit projects.</p> <p>9.5 Energy Audit procedure (walk through audit and detailed audit).</p> <p>9.6 Calculation of simple pay back period (Simple numerical)</p>	08	12
Total	48	100

Practical:**Skill to be developed:****Intellectual Skills:**

1. Identify different methods used for energy conservation.
2. Understand the importance of energy conservation.
3. Select proper tariff for given industry/institute.
4. Collect technical information regarding electricity act.

Motor Skills:

1. Prepare energy audit report.
2. Write visit report.
3. Use different methods of energy conservation.
4. Use of energy saving devices.

List of Practicals:

1. Collect the information about energy conservation act from IEE 2003.
2. Prepare a write up on role of Energy Manager and Energy Auditor.
3. Collect of information by market survey and prepare report on rating, luminous output, cost, list of manufacturers of various types of energy efficient luminaries (FTL, CFL, LED, Sodium Vapour, HPMV etc.)
4. Make a comparative study of energy efficient control gears and ballasts used in lighting system on the basis of energy efficiency, cost, life, energy saving and saving in energy bill
5. Visit to any organization where energy conservation program is implemented (Hospitals, workshops, institutes, commercial building, residential building etc.)
6. Using various energy audit instruments used for measurement of electrical, mechanical and thermal energy parameters, carryout energy audit and prepare a report as a case study for Residence, Small workshop, Public Library, Hospital etc.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
1	S. Sivanagraju M. Balasubba Reddy D. Srilatha	Generation And Utilization of Electrical Energy	Pearson, New Delhi
2	P. H. Henderson	India - The Energy Sector	University Press.
3	W. C. Turner	Energy Management Handbook	Wiley Press.
4	B. G. Desai J. S. Rana A. V. Dinesh R. Paraman	Efficient Use And Management Of Electricity In Industry	Devki Energy Consultancy PVT. Ltd

Websites:

1. Website of bureau of energy and efficiency : www.bee-india.nic.in
2. Website of Akshay Urja News Bulletin : www.mnes.nic.in
3. Notes on energy management on : www.energymanagertraining.com
4. www.greenbusiness.com
5. www.worldenergy.org

Course Name : Diploma in Agriculture Engineering

Course Code : AU

Semester : Sixth

Subject Title : Extension Methods of Transfer of Technology

Subject Code : 17679

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
03	--	--	03	100	--	--	--	100

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Seasonal Work (SW).**

Rationale:

The course is expected to enrich students knowledge for disseminating and transfer of agril and allied technology effectively. The student should communicate effectively with end user of technology and receive the feedbacks. The subject contents will enable the student for planning and evaluating of programmes. It also help to build technical competence for capacity building of farmers.

Objectives:

The student will be able to:

- 1) Achieve effective transfer of new technology.
- 2) Understand methods of technology disseminating and communicating.
- 3) Develop process for capacity building of farmers and extension workers.
- 4) Know programme planning and evaluating.

Theory:

Topic and Contents	Hours	Marks
Topic 1: Extension Education 1.1 Extension Education: <ul style="list-style-type: none"> • Meaning and definition • Scope • Objectives • principles 1.2 Communication <ul style="list-style-type: none"> • Meaning and definition • Models, Elements and their Characteristics, Barriers in Communication • Transfer of Technology (TOT): Meaning and definition 	07	10
Topic 2: Extension Programme Planning <ul style="list-style-type: none"> • Meaning and definition of Planning • Programme and Project • Importance of Extension Program Planning • Principles and steps in Programme Planning Process 	04	10
Topic 3. Monitoring and Evaluation 3.1 Monitoring <ul style="list-style-type: none"> • Meaning and definition • Modes of monitoring : 3.2 Evaluation <ul style="list-style-type: none"> • Meaning and definition • Types, ----- • Difference between Monitoring and Evaluation 	04	10
Topic 4. Extension Teaching Methods 4.1 Meaning and definition <ul style="list-style-type: none"> • Functions and Classification 4.2 Individual Contact Methods <ul style="list-style-type: none"> • Farm and Home Visit • Method and Result Demonstration • Demonstration of Field Trials • Merits and Demerits of Individual contact methods 4.3 Group Contact Methods <ul style="list-style-type: none"> • Group discussion • Method Demonstration • Field Trials • Meaning Objectives Steps • Merits and Demerits. • Group discussion Techniques • Lecture , Symposium, Panel Debate, Forum, Buzz group, Workshop, Brain Storming, Seminar and Conference 4.4 Mass Contact Methods <ul style="list-style-type: none"> • Campaign, Exhibition, Farmers rally, Radio and Television, Community Radio Stations • Factors influencing the selection of Extension 4.5 Teaching Methods and Combination of Teaching Methods <ul style="list-style-type: none"> • Advanced Information Sources 	13	28

<ul style="list-style-type: none"> Internet, Cyber Café, Video and Tele Conference, Kisan Call Centers, Consultancy Clinics. 		
Topic 5. Agricultural Information Sources: 5.1 Agricultural Journalism <ul style="list-style-type: none"> Meaning ,Scope and Importance 5.2 Agriculture Literature <ul style="list-style-type: none"> Forms of : Leaflet, Folder, Bulletin, Charts, Graphs News Meaning and definition, Sources of News, Types of News Merits and Demerits. 	06	12
Topic 6. Diffusion and Adoption of Innovations <ul style="list-style-type: none"> Meaning ,Scope and Importance Decision Process , adopter categories and their characteristics Factors influencing adoption process. 	04	10
Topic 7. Capacity Bulding of Extension Personnel and Farmers <ul style="list-style-type: none"> Meaning and definition Types of Training Training Steps Training to extension Personnel, farmers, farm women and Rural Youth and KVK. 	04	10
Topic 8. Extension systems in India <ul style="list-style-type: none"> Central and State Department of Agriculture Central and State Department of Rural Development ICAR Extension Programme and Voluntary Organizations 	06	10
Total	48	100

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
1	Kelsey I.D and Hearne,G.O	Cooperative Extension Work	Comstar Publishing, New Work
2	Ray G. l.	Extension Communication and Mangement	Nayaprakash, Culcutta
3	Sandhu A.S.	Textbook on Agricultural Communication	Oxford Publishing Pvt, New Delhi
4	Dudhani C.M.	Extension Teaching Methods and Communication	University of Agricultural Science, Dharwad
5	Reddy A.A.	Extension Education	Shree Lakshmi Press Andhra Pradesh
6	Hirevenkanagoudar L.V.	Extension Approches for Agriculture and Rural Development	University of Agricultural Science, Dharwad

Course Name : Diploma in Agriculture Engineering**Course Code : AU****Semester : Sixth****Subject Title : Seed Process Engineering****Subject Code : 17810****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
03	--	--	03	100	--	--	--	100

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Seasonal Work (SW).**

Rationale:

Seed is the basic and most critical input for sustainable agriculture. The response of all other inputs depends on quality of seeds to a large extent. It is estimated that the direct contribution of quality seed alone to the total production is about 15 - 20% depending upon the crop and it can be further raised up to 45% with efficient management of other inputs. The developments in the seed industry in India, particularly in the last 30 years, are very significant. Seed means life, and life needs cautiousness to grow. Processing of seeds is a matter of experience and in depth knowledge of various products and particular processes ideally suited to the specific processing task. Gentle handling, knowledge of seed processing and equipments, seed treatment, certification, packaging, storage, strict and genuine separation of different lots as well as highly accurate final purity and uniformity are the main supporting pillars of our approach, thus bringing us into the World market leader's position on the sensitive seed processing sector.

Objectives:

The student will be able to:

- 1) Know processing principles
- 2) Identify processing equipment and know their working
- 3) Learn to use seed treatment and testing of seeds
- 4) Know packaging and storage of seed.
- 5) Know the process of seed certification

Theory:

Sr. No.	Topic & Content	Hours	Marks
1	Seed Processing: Principle <ul style="list-style-type: none"> • Introduction • Seed processing industries in India, scope and future • Principles of seed processing • Study of physical characteristics of seed for separation 	02	04
2	Precleaning and Conditioning Equipment <ul style="list-style-type: none"> • Scalper • Debearder • Huller-Scarifier • Buckhorn machine 	02	04
3	Basic Seed Cleaning Equipment <ul style="list-style-type: none"> • Air screen cleaner • Construction, principle of operation, adjustment of equipment, techniques for precision cleaning, installation of air screen cleaner • Design considerations of air-screen cleaner • Numericals on Screen Effectiveness and Cleaning Efficiency 	04	08
4	Dimensional Sizing Equipment <ul style="list-style-type: none"> • Width & Thickness separator Types of Width & Thickness separator Principles of operation and adjustments of Width & Thickness separator • Vertical ribbed screen separator Principle of operation and Adjustment • Cylindrical screen separator (Principle of operation and Adjustment) • Uses and operation of width and thickness separators • Length separator Disc separator (Construction, principles of operation and adjustment) Cylinder separator (Construction, principles of operation and adjustment) Uses of length separator 	04	06
5	Specific Gravity Separator <ul style="list-style-type: none"> • Introduction • Construction • Principles of separation • Installation • Adjustments • Starting and operating sequence • Separation Problems • Deck shape, deck covers, maintenance and • Operator's record book 	04	08
6	Stoner <ul style="list-style-type: none"> • Introduction • Construction 	02	04

	<ul style="list-style-type: none"> • Principles of operation • Adjustments • Installation and summary 		
7	Roll Mill <ul style="list-style-type: none"> • Introduction • Construction • Principles of operation • Adjustments 	02	04
8	Magnetic Separator <ul style="list-style-type: none"> • Introduction • Construction • Principles of operation • Factors affecting magnetic cleaning of seed • Adjustments • Summary 	02	04
9	Inclined Draper <ul style="list-style-type: none"> • Introduction • Construction • Principles of operation • Adjustments • Summary 	02	04
10	Air Separator <ul style="list-style-type: none"> • Introduction • Construction • Principles of operation • Uses of air separator • Types of air separator Pneumatic separator, aspirator and scalping aspirator (Operation & Adjustments) • Summary 	02	06
11	Electronic Separator Electric Colour Sorter <ul style="list-style-type: none"> • Introduction • Construction • Principles of operation Electrostatic Separator <ul style="list-style-type: none"> • Introduction • Construction • Principles of operation • Factors affecting electrostatic separations • Uses of the electrostatic separator • Summary 	02	06
12	Miscellaneous Cleaning Equipment Spiral Separator <ul style="list-style-type: none"> • Introduction • Construction • Principles of operation • Adjustments • Use of spiral separator 	02	08

	<p>Polishers</p> <ul style="list-style-type: none"> • Types of polishers • Principles of operation • Uses <p>Vibratory Separator</p> <ul style="list-style-type: none"> • Introduction • Principles of operation and • Uses 		
13	<p>Seed Treatments</p> <ul style="list-style-type: none"> • Introduction • Benefits of seed treatments • Types of seed treatment • Seed treating products • Equipments for seed treatments Slurry treaters and Mist-o-matic treater • Colouring of seed • Causes of poor treatments • Precautions in seed treatments 	04	08
14	<p>Seed Testing</p> <ul style="list-style-type: none"> • Introduction • History of seed testing • Seed testing laboratory • Plan for seed testing laboratory <p>General principles Staff Equipments Management of seed testing work Probable causes of discrepancies of seed test results</p>	04	06
15	<p>Minimum Seed Certification Standards</p> <ul style="list-style-type: none"> • Introduction • General seed certification standards • Specific crop standards <p>Field standards and Seed standards</p>	02	04
16	<p>Seed Packaging and Handling</p> <ul style="list-style-type: none"> • Introduction • Equipments used for packaging of seeds The bagger weigher Manual weighing Semiautomatic weighing Automatic weighing Bag sewing machine • Elevating and conveying equipments and their use Bucket elevator Belt conveyor Vibrating conveyors Pneumatic conveyors Screw conveyor Chain conveyor and Lift trucks 	04	08

17	Seed Storage <ul style="list-style-type: none"> • Purpose of seed storage • Stages of seed storage • General principles of seed storage • Constructional features for good seed warehouse 	02	04
18	Seed Marketing and Distribution <ul style="list-style-type: none"> • Introduction • Demand forecasts • Marketing structure • Marketing organization 	02	04
Total		48	100

Practical:**Skills to be developed:****Intellectual Skills:**

1. Select method for Processing for good quality seed.
2. Select equipment used for seed processing.
3. Use appropriate Packaging and storage.

Motor Skills:

1. Seed cleaning and grading.
2. Handling seed processing equipments.
3. Seed treatments.
4. Seed testing.
5. Packaging of seed.

List of Practicals:

1. Study operation of grain pre-cleaners through samples.
2. Study operation of grain cleaner-cum-grader through actual use.
3. Study of indented cylinder separator: Operation, safety precautions, limitations.
4. Study of specific gravity separator: Operation, safety precautions, limitations.
5. Study of seed treater.
6. Study of seed bagging operations (Weighing, bagging, stitching, labeling)
7. Seed sample testing (moisture content, physical purity and germination.)
8. Study of operational process flow chart for seed processing.
9. Study of seed storage.
10. Visit to seed processing plant / Ware house : Visit report including layout.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
1	Vaughan C.E. Gregg B.R. and J.C. Delouche	Seed Processing and Handling	Seed Technology Laboratory, Mississippi State University, USA.
2	R.L. Agrawal.	Seed Technology	Oxford and IBH Pub. Co. P. Ltd., New Delhi.
3	Sahay K. M. and Singh K. K.	Unit Operations of Agricultural Processing	Vikas Publishing House Pvt. Ltd., New Delhi.

Course Name : Diploma in Agriculture Engineering

Course Code : AU

Semester : Sixth

Subject Title : Operation, Maintenance & Testing of Farm Equipment

Subject Code : 17810

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
--	--	02	--	--	50#	--	25@	75

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Seasonal Work (SW).**

Rationale:

The diploma holder should know the complete operation and maintenance of the farm machinery and equipment. All tests procedures are also to be known to the diploma engineer. In this subject all such details are covered. The student will be well conversant with all operations and testing procedures after studying this subject. This subject is to be taught through practicals so that required hands on skills also will be developed.

Objectives:

The student will be able to:

1. Operate farm equipments including tractor.
2. Find the faults and repair the machinery and equipments.
3. Observe all safety rules.

Theory:**Note: Related theory to be taught during practicals**

Topic and Contents
<p>1.Tractor:</p> <ul style="list-style-type: none"> • Familiarization with different makes & models of 4-wheeled tractors. • Introduction to various systems of a tractor viz. fuel, lubrication, cooling, electrical, transmission, hydraulic & final drive system. • Familiarisation with instrumentation panel & controls; • Familiarization with tractor controls and learning procedure of tractor starting and stopping. Starting and stopping practice of the tractor • Driving in forward and reverse gears. • Hitching, adjustments, settings and field operation of farm machinery
<p>2. Driving of Tractors and use of implements</p> <ul style="list-style-type: none"> • Road signs, traffic rules, road safety, driving and parking of tractor; Tractor driving practice forward & reverse driving practice; • Tractor driving practice with two wheeled tractor trailer forward and reverse driving • Study and practicing the hitching and detaching of implements • Study operation and field adjustments of M. B. Plough and Disk Plough • Field operation of trailing and mounted disk harrow, tine cultivator and ridger • Field operation and adjustments of seed drill/planter/sprayer.

Practical:**Skills to be developed:****Intellectual Skills:**

1. Interpret the road signs and traffic rules for safe driving.
2. Know the procedure of hitching and de-hitching of implements.
3. Know the operation and adjustments of various implements.
4. Select the implement for specific operation.

Motor Skills:

1. Drive following all safety and traffic rules/norms.
2. Attach properly the implements for safe operation.
3. Operate the tractor and farm implements efficiently and safely.

Practicals:

1. Familiarization with tractor controls and learning procedure.
2. Familiarization with tractor driving safety rules. Familiarization with tractor driving in forward and reverse gears.
3. Familiarization with tractor hitching system. Field operation with M. B. plough & its adjustment.
4. Field operation with disc plough and its adjustment.
5. Field operation with seed drill / planter and its adjustment.
6. Field operation with tractor trolley (forward and reverse).
7. Field operation with tractor operated disc harrow, tine cultivator and ridger and its adjustments.
8. Field operation with tractor operated rotavator and its adjustment.
9. Field operation with reaper and its adjustment.
10. Field operation with mower and its adjustment.
11. Familiarization with power tiller driving in forward and reverse gear.
12. Familiarization with tractor operated sprayer.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
1	S C. Jain & C. R. Rai	Farm tractor maintenance & repair second edition, 1999	Standard Publishers Distributors, New Delhi
2	CP Nakra,	Farm machines & Equipment Edition 1990.	Dhanpat Rai & Sons, 1962, Nai Sarak Delhi.
3	A.C. Srivastava	Elements of Farm Machinery	Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, Bombay
4	Donel Hunt.	Farm Power Machinery Management	Low State Univ. Press. Ames Low. The operation care and repairs of Farm machinery, Deere and Company.
5	Dr. T.K. Bhattacharya	A Work book of Practical Farm Machinery, Volume-I and Volume-2	Saroj Prakashan, 646 Katra, Allahabad – 211 002.

Course Name : Diploma in Agriculture Engineering

Course Code : AU

Semester : Sixth

Subject Title : Project

Subject Code : 17811

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	04	--	--	--	50#	50@	100

Rationale:

Project work aims at developing skills in the students whereby they apply the totality of knowledge and skills gained through the course in the solution of particular problem or undertaking a project. The students have various aptitudes and strengths. Project work, therefore, should match the strengths of students.

Objectives:

The student will be able to,

1. Analyze the given problem.
2. Generate alternative solutions to the problem.
3. Compare & select feasible solutions amongst alternative generated.
4. Develop and manufacture new/modified equipments.
5. Acquire technical knowledge beyond curriculum.

CONTENT:

The project should be taken in close collaboration with the employing agencies. The project shall involve selection, analysis and solution of special problems related to farm implement, machinery and power/soil and water engineering/agricultural process engineering applicable to Indian conditions.

- The project will be assigned to individual student or to a group of students not exceeding 5 as per problem.

Project will consist of any one of:

- (a) Rural Development
- (b) Operation of agricultural machinery: power tiller and tractors.
- (c) Problem concerning to any one of the following:
 - Run own workshop for repair and maintenance of agricultural implements.
 - Levelling and Irrigation-Drainage and soil-water conservation needs of farms.
 - Establish an agro based small scale rural industry.
 - Any other problem concerning agriculture.
- (d) Any other similar project related to Agricultural Engineering

At the end of the project student will submit a written report of his/ their accomplishment and face a viva voce examination individually.

Following activities related to project are required to be dealt with, during this semester

1. The Selection and preliminary work regarding Project to be done as per the direction of the Project Guide, who will be guiding the students for project work
2. The identified projects are executed during the semester as per the Guidance from the project Guide by the group of students (Group size max. 5 students).
3. Maintain the project diary individually for the activities performed in the format specified below.

Project Diary format:

Sr. No.	Date	Activity Carried out	Remarks	Signature of Guide

Note:

Project should provide viable and feasible solution to the problem identified.

Report should be of 40 To 50 pages.

Project report contents should be as follows:

1. Main title: 14 bold Times new roman
2. Sub titles: 12 bold Times new roman
3. Running matter: 12 Times new roman, paragraph 1.5 line spacing,
4. Margin spacing 4 cm (1.5 inches) from left and 2.5 cm (1 inch) from other sides.
The report should be on A 4 size paper.

Preferably actual photographs / video clips showing progress of project work at different stages (to be added to project report).

Suggested framework for the project report:

The topics / contents of the project report should be as follows

- ✚ Abstract
- ✚ Topic introduction / Philosophy
- ✚ Literature Survey / Methodology adopted
- ✚ Principle (aim objectives of the Project work)
- ✚ Data collection / Design consideration/Basic Framework / Design / Drawing
- ✚ Manufacturing Processes and Process Sheets (if relevant)
- ✚ Assembly (if relevant)
- ✚ Performance / Calculations etc. (If relevant)
- ✚ Costing
- ✚ Results and Discussion
- ✚ Conclusion
- ✚ Future Scope
- ✚ Bibliography/ References

Learning Resources:**Reference Books:**

Sr. No.	Name of Book	Author	Publisher
1	Project Management	Maylor	Pearson Education
2	Project Management and Appraisal	Khatua	Oxford University Press
3	Project Management/2/e	Bhavesh patel	Vikas Publishing house
4	Project Management 3/e	Vasant Desai	Himalaya publishing House
5	Project Management The Managerial Approach	Gray	TMH