

OBJECTIVES

Course No:- ENGG – 364 (NEW)

Protected Cultivation and secondary Agriculture



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Lecture No. 01

Green house technology

Q. 1. Fill in the blanks.

- a) Percentage of carbon dioxide in atmosphere is.....
- b) CEA stands for
- c) The first use of ployehylene as a greenhouse cover was in
- d) The total area of glasshouse in the world was estimated to be.....
- e) In 16th century..... were used to protect horticultural crops.

Q. 2. Match the pairs

- | | |
|-----------------|--|
| a) 16th century | i) Area of 6,82,050 ha were under plastic greenhouse |
| b) During 1700s | ii) Greenhouse uses glass as a slopping roof |
| c) 1948 | iii) Bell jars, hot beds are used to protect horticultural crops |
| d) 1999 | iv) 100 ha of India are under greenhouse cultivation |
| e) 1994-95 | v) First use of polyethylene |

Q. 3. True or false

- a) Due to greenhouse effect atmospheric temperature increase and causes global warming.
- b) Percentage of germination of seed is lower in greenhouse.
- c) Greenhouse of today can be considered as a plant or vegetable factory.
- d) Greenhouse effect is undesirable effect for crop growth in cold region.
- e) The acclimatization of plantlets of tissue culture technique can be carried under greenhouse.

Q. 4. Choose correct option

- a) Increase in ambient temperature, dueto formation of blanket of carbon dioxide is known as

i) Global warming	ii) Greenhouse effect
iii) Both (i)&(ii)	iv) None of these
- b) Percentage of carbon dioxide in atmosphere is

i) 0.038	ii) 0.030
iii) 0.035	iv) 0.029
- c) Various inputs which are well maintained in greenhouse are

- i) Water
- ii) Fertilizers
- iii) Plant protection chemical
- iv) All of these
- d) Growing media used in greenhouse are
 - i) Rice hulls
 - ii) Vermiculite
 - iii) both (i)&(ii)
 - iv) None of these
- e) .The first use of polyethylene was in
 - i) 1949
 - ii) 1948
 - iii) 1999
 - iv) 1947

Q. 5. Do as directed

- a) Define greenhouse.
- b) What is greenhouse effect?
- c) Give full form of CEA.
- d) Name the fruits which uses glasshouse for production.
- e) When the protected agriculture was fully established?

Answer Key (Lecture No. 01)

Q. 1. Fill in the blanks.

- a) 0.035%
- b) Controlled environment agriculture
- c) 1948
- d) 30,000 ha
- e) Glass lantern, bell jars, hot beds

Q. 2

- a) Bell jars, hot beds were used to protect horticultural crops.
- b) Greenhouse used glass as a slopping roof.
- c) First use of polyethylene
- d) Area of 6,82,050 ha were under plastic greenhouse
- e) 100 ha of India under greenhouse cultivation

Q. 3

- a) True
- b) False
- c) True
- d) False
- e) True

Q. 4

- a) Greenhouse effect
- b) 0.035
- c) All of these
- d) Both (i) & (ii)
- e) 1948

Q. 5

- a) A greenhouse is a framed or inflated structure covered with a translucent or transparent material in which crops could be grown under condition of at least partially controlled environment & which is large enough to permit person to work within it to carry out cultural operation.
- b) The phenomenon of increase in the ambient temperature due to formation of blanket of carbon dioxide is called as greenhouse effect.
- c) CEA-controlled environment agriculture.
- d) Melon, grapes, peaches, strawberries.
- e) The protected agriculture was fully established with the introduction of polyethylene after World War II.

Lecture No. 02

Types of Green house

Q. 1. Fill in the blanks.

- a) The length of even-span type greenhouse is
- b) are major & important components of greenhouse structure.
- c) Uneven-span type greenhouse constructed on
- d) High grade panelshave a life upto
- e) Covering material in panel greenhouse is more resistant to. &

Q. 2. Match the pairs

- | | |
|-----------------------------|------------------------------------|
| a) Plastic film | i) For active cooling |
| b) Thermo pane glasses | ii) Fibre glass reinforced plastic |
| c) Evaporative cooling pads | iii) Polyethylene |
| d) Glass greenhouse | iv) To reduce heat loss |
| e) Panel greenhouse | v) Higher air infiltration rate |

Q. 3. True or false

- a) The longitudinal section of the greenhouse can be used for classification.
- b) Even -span type greenhouse has less flexibility in design.
- c) If the greenhouse span is greater than or equal to 15m, truss frames are used.
- d) Covering materials are major and important component of the greenhouse structure.
- e) Shading nets provide appropriate microclimate to plants.

Q. 4. Choose correct option

- a) Width of lean to type greenhouse is

i) 7-12 feet	ii) 4-10 feet
iii) 8-12 feet	iv) 5-13 feet
- b) The greenhouse classification based on construction

i) Greenhouse for active cooling	ii) Truss framed greenhouse
iii) Ridge & furrow greenhouse	iv) Shading nets
- c) The height of even-span type greenhouse varies from

i) 2.0-3.0m	ii) 3.0-4.0m
iii) 2.5-4.3m	iv) 1.5-2.5m
- d) For wooden framed structure, span used are

- i) <7m
- ii) <6m
- iii) <8m
- iv) <9m
- e) The design used for construction of glass greenhouse are
 - i) Lean to type
 - ii) Ridge & furrow
 - iii) Even-span type
 - iv) All of above

Q. 5. Do as directed

- a) Give classification of greenhouse based on shape.
- b) Write the advantage of lean to type greenhouse.
- c) Write the function of span.
- d) Classify greenhouse based on covering material.
- e) Name the different covering materials used in plastic film greenhouse.

Answer Key(Lecture No. 02)

Q. 1. Fill in the blanks.

- a) 24m
- b) Covering material
- c) Hilly terrain
- d) 20 years
- e) Breakage & light intensity

Q. 2

- a) Polyethylene
- b) To reduce the heat loss
- c) For active cooling
- d) Higher air infiltration rate
- e) Fibre glass reinforced plastic

Q. 3

- a) False
- b) False
- c) True
- d) True
- e) True

Q. 4

- a) 7-12 feet
- b) Truss framed
- c) 2.5-4.3 m
- d) <6m
- e) All of above

Q. 5

- a) Lean to type, even span type, uneven span type, ridge & furrow type, saw tooth type, Quonset type.
- b) 1. It is usually close to available electricity, water & heat.
2. Least expensive structure.
- c) Span dictates the selection of structural members & their construction.
- d) Glass greenhouse, plastic film, rigid panel, shading nets.
- e) Polyethylene, polyester, polyvinyl chloride.

Lecture No. 03

Plant Response To Green House Environment

Q. 1. Fill in the blanks.

- a) Light intensity is measured by.....
- b) Light intensity of greenhouse crops varies from.....
- c) UV light is available in..... wavelength
- d) Visible light ranges from.....
- e) CO₂ level in atmosphere.....

Q. 2. Match the pairs

- | | |
|--------------------|------------------------|
| a) UV light | i) 0.03% |
| b) CO ₂ | ii) 50 – 80 % |
| c) RH | iii) 325 nm |
| d) Enzymes | iv) Shorter wavelength |
| e) Glass screen | v) Biological catalyst |

Q. 3. True or false

- a) To maintain desirable humidity level only humidification process is carried out.
- b) If light intensity is diminished, the photosynthetic rate becomes faster
- c) Not all light is used in photosynthesis
- d) Temperature is measure of heat present.
- e) In blue and red bands photosynthetic activity is higher.

Q. 4. Choose correct option

- a) Greenhouse crops are grown at day temp..... degree celsius.

i) 3 - 6	ii) 2-3
iii) 4-5	iv) 3-9
- b) Visible light ranges from..... nm

i) 400 -700	ii) 100-200
iii) 500 - 600	iv) 700-800
- c) Light intensity is measured in..... (international unit)

i) lux	ii) watt
iii) klux	iv) kwatt
- d) CO₂ present in atmosphere.....%

- i) 0.03
- ii) 0.3
- iii) 0.003
- iv) 3
- e) In case of small greenhouse type of ventilation is effective.
 - i) natural
 - ii) artificial
 - iii) Fan
 - iv) pad

Q. 5. Do as directed

- a) Components of crop microclimate.
- b) Rate of photosynthesis is governed by
- c) Wavelength of white light.....
- d) Use of ventilation in greenhouse.
- e) Use of fan ventilation.

Answer Key (Lecture No. 03)

Q. 1. Fill in the blanks.

- a) Lux
- b) 129.6 klux- 3.2 klux
- c) Less than 400nm
- d) 400 – 700nm
- e) 0.003%

Q. 2

- a) iv
- b) i
- c) ii
- d) v
- e) iii

Q. 3

- a) False
- b) False
- c) True
- d) True
- e) True

Q. 4

- a) 3 - 6
- b) 400 - 700
- c) lux
- d) 0.03
- e) natural

Q. 5

- a) Light,temperatue ,air components,nature of root medium.
- b) Water,Co2,light,temperature.
- c) 400 – 700nm
- d) Reducing temp. in greenhouse.
- e) Precise control over air temp. humidity and C02

Lecture No. 04

Planning and Design of green house

Q. 1. Fill in the blanks.

- a) Greenhouse structure should be designed to resist a _____ km/hr wind velocity.
- b) _____ acts as a barrier between plant production areas and external or general environment.
- c) Trees should be located at a distance of _____ times their height from greenhouse.
- d) Greenhouse should be oriented in _____ direction for getting maximum advantage of sunlight.
- e) A _____ type greenhouse is suitable for low growing crops such as lettuce.

Q. 2. Match the pairs

- | | |
|--|----------------------|
| a) Glass and acrylic sheet | i) 2 to 3 years |
| b) Polycarbonate and fiberglass reinforced polyester sheet | ii) 2 to 6 months |
| c) Polyethylene | iii) 5 to 12 years |
| d) Polyethylene stabilized for UV rays | iv) 20 or more years |

Q. 3. True or false

- a) Covering material of greenhouse should not be visible for solar radiations.
- b) Greenhouse should not be ventilated.
- c) Greenhouse can be constructed on undulating land.
- d) While developing greenhouse it is important to develop greenhouse with a maximum intensity of natural light.

Q. 4. Choose correct option

- a) Choose the correct sentence.

i) Greenhouse should be oriented in East-West direction	ii) Greenhouse should not be transparent for visible light
iii) Site for greenhouse should be levelled	iv) All of the above
- b) It is important to develop greenhouse with _____ intensity of natural light inside.

i) Minimum	ii) Maximum
iii) Natural	iv) Moderate
- c) _____ and _____ shaped roofs are widely used for constructing greenhouse.

i) Arched & straight	ii) Arched & gable
iii) Gable & curved	iv) None of these
- d) Arched roof and hoop style Greenhouse are most often constructed of _____ material

i) PVC pipe	ii) Galvanized iron pipe
iii) Steel pipe	iv) None of these

Q. 5. Do as directed

- a) Define greenhouse.
- b) Give any two types of roof used in the construction of greenhouse.
- c) Give any two names of covering material used in construction of greenhouse.
- d) Write any two points for site selection of greenhouse.

Answer Key (Lecture No. 04)

Q. 1. Fill in the blanks.

- a) 130
- b) Greenhouse
- c) 2.5
- d) North-south
- e) Hoop type

Q. 2

- a) iv) 20 or more years
- b) iii) 5 to 12 years
- c) ii) 2 to 6 months
- d) i) 2 to 3 years

Q. 3

- a) False (Greenhouse should be visible for solar radiations).
- b) False (Greenhouse must be ventilated)
- c) False (Land should be levelled)
- d) True

Q. 4

- a) iii) Site of greenhouse should be levelled
- b) ii) Maximum
- c) ii) Arched & gable
- d) ii) Galvanized iron pipe

Q. 5

- a) A greenhouse is a framed or inflated structure covered with a transparent or translucent material in which crops could be grown under the condition of at least controlled environment and which is large enough to permit person within it to carry out cultural operations.
- b) Side wall with arch roof, hoof type roof, gothic arch frame roof, side wall with gothic roof.
- c) Glass and acryl sheet, polyethylene, polycarbonate and fiberglass reinforced polyester sheet, polyethylene stabilized for UV rays.
- d) Site should be well drained.
It should be as level as possible.
It should be well aerated and should receive good solar radiations.
Advisable to select a site with natural windbreaker.

Lecture No. 05

Materials of construction for traditional and low cost green house

Q.1. Fill in the blanks.

- a) _____ And _____ are generally used for low cost Polyhouse.
- b) Aluminum and steel must be protected by painting with _____ to protect against corrosion.
- c) _____ is generally limited to foundation and low walls.
- d) Hammered and tempered glass has a thickness of _____.
- e) FRP stands for _____.

Q.2. Match the pairs

- | | | |
|--------------------------------|------|------------------|
| a) Electro-galvanizing process | i) | Cypress/Red wood |
| b) Single drawn/Float glass | ii) | Cold process |
| c) Hammered and tempered glass | iii) | Pine |
| d) Decay resistance wood | iv) | 4mm |
| e) Less expensive wood | v) | 3-4mm |

Q.3. True or false

- a) Wood must be painted with black color paint to improve light condition within greenhouse.
- b) Electro-galvanizing process is hot process.
- c) Galvanizing process makes the iron rust proof.
- d) RCC refers to Resistant concrete cement.
- e) Hammered glass is transparent, but not translucent

Q.4. Choose correct option

- a) Which of the following are less expensive wood?

i) Red wood	ii)	Pine
iii) Casuarina	iv)	Both 'ii' & 'iii'
- b) _____ can be used in desert / tropical region.

i) Red wood/cypress	ii)	Pine
iii) Casuarina	iv)	None
- c) Which of the following processes are used to protect against corrosion?

i) Hot dip galvanizing	ii)	Electro-galvanizing
iii) Coating with paint	iv)	All of the above
- d) Hammered and tempered glass has a thickness of _____.

i) 4cm	ii)	3cm
iii) 4mm	iv)	3-4mm

Q.5. Do as directed

- a) Give any two names of less expensive wood.
- b) Give the names of water based preservatives applied to wood.
- c) Give the name of natural decay resistance wood.
- d) RCC and PVC stands for _____ and _____ respectively.
- e) Name the widely used glass for Greenhouse.

- f) Write any two processes to protect against corrosion.

Answer Key (Lecture No. 05)

Q. 1. Fill in the blanks.

- a) Wood and Bamboo
- b) Bitumen tar
- c) RCC
- d) 4mm
- e) Fiberglass –reinforced plastic.

Q. 2 Match the pairs.

- a) ii)Cold process
- b) v)3-4mm
- c) iv)4mm
- d) i)Cypress/Red wood
- e) iii)Pine

Q.3 True or false

- a) False
(White color paint)
- b) False
(Cold process)
- c) True
- d) False
(Reinforced cement concrete)
- e) False
(Hammered glass is not transparent but it is translucent.)

Q.4 Choose correct option

- a) iv)Both 'ii' & 'iii'
- b) i)Red wood/cypress
- c) iv)All of the above
- d) iii)4mm

Q. 5 Do as directed

- a) Pine, Casuarina
- b) Chromated copper arsenate, Ammonical copper arsenate.
- c) Red wood/cypress
- d) RCC-Reinforced cement concrete
PVC-Polyvinyl chlorine film.
- e) Single drawn/Float glass, Hammered and tempered glass
- f) Hot dip galvanizing, Electro-galvanizing

Lecture No. 06

Irrigation Systems used in green house

Q. 1. Fill in the blanks.

- a) Drip irrigation often referred as _____
- b) Fog particles size typically in high pressure greenhouse system is __micron.
- c) _____irrigationn is the best means of water conservation.
- d) VPD stands for _____
- e) The difference between saturation water vapour pressure and Ambient water vapour pressure is known as _____.

Q. 2. Match the pairs

- | | |
|-----------------------|--------------------|
| a) Fog particle | i) Laterals |
| b) Mist particle | ii) Riser |
| c) Piping | iii) Ceramic |
| d) Nozzle | iv) Copper |
| e) Overhead sprinkler | v) 50 to 100micron |
| f) Drip irrigation | vi) 10 micron |

Q. 3. True or false

- a) Boom watering is also known as trickle irrigation.
- b) A nozzle is installed at the top of each riser in overhead sprinkler.
- c) Water should be applied after initial moisture stress.
- d) Riser height should be 1.8 m for bedding plants.
- e) In greenhouse particle size of mist is 10 micron.

Q. 4. Choose correct option

- a) Which of the following is the rule of watering ?

i) Use a well drained substrate with good structure	ii) Water just before initial moisture stress
iii) Water throughly each time	iv) All of the above
- b) Basic equipment of drip irrigation ____

i) Pump	ii) Riser
iii) Main line	iv) Both i and. iii
- c) Particle size typically used in high pressure greenhouse fog system is ____micron.

i) 50 micron	ii) 10 micron
iii) 50 to 100 micron	iv) None
- d) Which of the following material is used for the piping?

i) Plastic	ii) Ceramic
iii) Reinforced flexible hose	iv) None
- e) Piston pumps are needed to develop ____to____psi pressure to get 10 to 20 micron size droplets.

i) 500 to 600	ii) 800 to 1200
iii) 800 to 1000	iv) 700 to 900

Q. 5. Do as directed

- a) Define VPD.
- b) Material used for nozzles.
- c) Give any four components of drip irrigation.
- d) What are other systems of watering in greenhouse.
- e) Give the differential point between fog and mist.

Answer Key (Lecture No. 06)

Q. 1. Fill in the blanks.

- a) Trickle irrigation.
- b) 10 micron.
- c) Drip irrigation.
- d) Vapour pressure deficit.
- e) VPD.

Q. 2

- a) vi) 10 micron
- b) v) 50 to 100 micron
- c) iv) Copper
- d) iii) ceramic
- e) ii) Riser
- f) i) Laterals

Q. 3

- a) False (Drip irrigation is also known as trickle irrigation)
- b) True
- c) False (water should be applied before initial moisture stress)
- d) False (Riser height should be 0.6m for bedding plants)
- e) False.(Mist particle size should be 50 to 100 micron)

Q. 4

- a) iv) all
- b) iv) both i and iii
- c) ii) 10 micron
- d) iii) Reinforced flexible hose
- e) ii) 800 to 1200

Q. 5

- a) VPD -The difference between saturation water vapour pressure and Ambient water vapour pressure is known as VPD.
- b) Plastic, ceramic, stainless steel.
- c) Main line, Laterals, Nozzle, emitter.
- d) Hand watering, perimeter watering, boom watering.
- e) Fog particles are lighter having size of 10 micron, while mist particles are heavier having size of 50 to 100 micron.

Lecture No. 07

Design criteria of green house for Cooling and Heating purposes

Q. 1. Fill in the blanks.

- a) The ventilators on the roof as well as those on the side wall accounts, each about _____% of the total roof area.
- b) The common height of door of a greenhouse is _____.
- c) Two or more greenhouse in one location are called as _____.
- d) 1 kg of water can hold _____ of heat for one degree rise in temperature.
- e) The outside air is cooled to _____ degree in fan and pad cooling system.

Q. 2. Match the pairs

- | | |
|---|-----------------------------|
| a) 1kg water | i) 35-70 kg/cm ² |
| b) 1 kg rock | ii) 71.1 KJ |
| c) High pressure mist system | iii) 1m |
| d) Low pressure mist system | iv) 14.2 KJ |
| e) Height of pad for 20 m pan to fan distance | v) 7 kg/cm ² |

Q. 3. True or false

- a) Foggers are used as a cooling system in forced ventilation system.
- b) A greenhouse itself can be considered as a solar collector.
- c) Rocks can store about 0.83 kJ for each 1oC
- d) Thermostat is used to regulate temperature in greenhouse.
- e) Fan and pad cooling system is used only in small greenhouse.

Q. 4. Choose correct option

- a) _____ ventilation is utilized as the first stage of cooling,

i) Active	ii) Passive
iii) Natural	iv) None of the above
- b) _____ systems are the second stage of cooling when passive systems are inadequate.

i) Passive	ii) Active
iii) Fogging	iv) None of them
- c) Most common heating system used in greenhouse is _____.

i) Unit heater system	ii) Foggers
iii) Fan and pad system	iv) None of them
- d) _____ heating is used as an alternative to fossil fuel heating system.

i) Unit heater system	ii) Control heat system
iii) Solar heating	iv) Radiation heating system
- e) The most common material for storage of heat in greenhouse is _____.

i) Soil	ii) Water
iii) Rocks	iv) Both ii and iii

Q. 5. Do as directed

- a) What is used to regulate humidity in greenhouse.

- b) Define ventilation.
- c) Define head house
- d) Leaching of soil nutrients is drawback of which cooling system.
- e) Which is the efficient pad material

Answer Key (Lecture No. 07)

Q. 1. Fill in the blanks.

- a) 10
- b) 2.7m
- c) Greenhouse range
- d) 4.23 KJ
- e) 3-12 degree

Q. 2

- a) ii
- b) iv
- c) i
- d) V
- e) iii

Q. 3

- a) False
- b) True
- c) True
- d) True
- e) False.

Q. 4

- a) ii
- b) iii
- c) i
- d) iii
- e) iv

Q. 5

- a) Humidistat
- b) Ventilation is the process of allowing the fresh air to enter into the enclosed area by driving out the air with undesirable properties.
- c) A building associated with the greenhouses that is used for storage or for operations in support of growing of plants, is referred to as a service building or head house.
- d) Low pressure mist system
- e) Honey comb cellulose paper

Lecture No. 08

Engineering Properties - Engineering Properties of cereals, pulses and oil seed.

Q. 1. Fill in the blanks.

- a) _____ is used to describe shape of grains.
- b) _____ is used to describe size of grains.
- c) In the condition of free fall particle attains _____ velocity.
- d) The ratio between the force of friction (F), and the force normal to the surface of contact (N), is known as the _____.
- e) Equipment occupying large floor areas should have a clearance of _____ or more to facilitate cleaning.

Q. 2. Match the pairs

- | | |
|----------------------------|---|
| a) Sphericity | i) $C_p = Q/m$. |
| b) GMD | ii) $\varepsilon = \frac{P_t P_b}{P_t} * 100$ |
| | Pt |
| c) Porosity | iii) $\phi = \frac{abc^{1/3}}{a}$ |
| d) Coefficient of friction | iv) $(abc)^{1/3}$ |
| e) Specific heat | v) $\mu = \frac{E}{N}$ |

Q. 3 Choose correct option

- a) Resistance of bulk grain to airflow is a function of the _____ and _____
 - i) Size and shape
 - ii) Viscosity and porosity
 - iii) Porosity and bulk density
 - iv) Porosity and kernel size.
- b) Give long form GMD
 - i) Geometry measuring device
 - ii) Geometrical mean diameter
 - iii) Geographically mean depth
 - iv) None of them
- c) At terminal velocity net accelerating gravitational force is _____ to upward drag force.
 - i) Less than
 - ii) More than
 - iii) Equal to
 - iv) None of the above

Q. 4 Do as directed

- a) Define shape
- b) Define sphericity.
- c) Define angle of repose.
- d) Define specific heat.

- e) Define thermal conductivity.

Answer Key (Lecture No. 08)

Q. 1. Fill in the blanks.

- a) Sphericity
- b) Equivalent diameter
- c) Terminal
- d) Coefficient of friction
- e) 46cm

Q. 2

- a) iii
- b) iv
- c) ii
- d) V
- e) i

Q. 3

- a) iv
- b) ii
- c) iii

Q. 4

- a) Size of the grain refers to the characteristics of an object which in term determine how much space it occupies and, within limits, can be described in terms of length, width, and thickness.
- b) The sphericity (ϕ) defined as the ratio of the surface area of sphere having the same volume as that of the grain to the surface area of the grain
- c) The angle of repose is the angle between the base and the slope of the cone formed on a free vertical fall of the grain mass to a horizontal plane.
- d) Specific heat of a substance is defined as the amount of heat required to raise the temperature of unit mass through 1oC.
- e) The thermal conductivity is defined as the amount of heat flow through unit thickness of material over an unit area per unit time for unit temperature difference.

Lecture No. 09

Drying and Dehydration

Q. 1. Fill in the blanks.

- a) Thickness of grain bed for thin layer drying is _____.
- b) The wavelength range for radiation drying is _____.
- c) _____ dryers use heated sand for drying.
- d) When the group of trays is in moving condition the system is called _____.
- e) In continuous flow dryers, a _____ system is used to avoid excessive drying stress.

Q. 2. Match the pairs

- | | |
|----------------------------------|---------------------------------|
| a) Convection drying | i) Henderson |
| b) Conduction drying | ii) TNAU |
| c) Equilibrium moisture content | iii) Louisiana university |
| d) LSU dryers | iv) Drying of parboiled grain |
| e) Continuous type rotary dryers | v) Drying of all types of grain |

Q. 3. True or false

- a) Drying is defined as removing of moisture of a substance to it's bone dry conditions.
- b) An air flow rate of 2.94-3.92 m³ /min is recommended for deep bed drying.
- c) Drying air temperature of non mixing type dryers is 65 degree c.
- d) Perforated trays are used when the plenum chamber is at the bottom of drying chamber.
- e) In desiccated air drying grains are desiccated by silica gel.

Q. 4. Choose correct option

- a) _____ involves dewatering of cellular products

i) Osmotic drying	ii) Fluidised bed drying
iii) Super heated steam dryers	iv) None of the above
- b) The materials used for osmotic drying are _____.

i) 40% Saccharose	ii) 60% saccharose
iii) 25% NaCl	iv) Both ii and iii
- c) Capacity of flat bed dryers is

i) 5-6 tons	ii) 1-2 tons
iii) 3-4 tons	iv) 10tons
- d) LSU dryers is mainly developed for _____.

i) Wheat	ii) Bajra
iii) Rice	iv) Maize
- e) The drying temperature in mixing dryers used is _____.

i) 56 degree	ii) 65 degree
iii) 78 degree	iv) 121 degree

Q. 5. Do as directed

- a) Which material is used to desiccate the air in desiccated air drying.
- b) Define drying front.
- c) Define equilibrium moisture content.
- d) Define dehydration.
- e) Define drying.

Answer Key (Lecture No. 09)**Q. 1. Fill in the blanks.**

- a) 20 cm
- b) 0.76 to 400 nm
- c) Continuous type rotary dryers
- d) Tunnel dryers
- e) Multipass

Q. 2

- a) V
- b) IV
- c) I
- d) III
- e) II

Q. 3

- a) False
- b) True
- c) False
- d) True
- e) False

Q. 4

- a) i
- b) iv
- c) ii
- d) iii
- e) ii

Q. 5

- a) Silica gel
- b) The upper edge of the drying zone at the interface with the wet zone is called the drying front.
- c) The air passes through the dried zone and picks up moisture in the drying zone until it reaches equilibrium moisture content (EMC) in the case of very wet grain
- d) Dehydration means removal moisture to bone dry conditions.
- e) Drying is defined as removal of moisture content to it's predetermined level.

Lecture No. 10, 11 & 12

Moisture Measurements & Various Drying Methods

Q. 1. Fill in the blanks.

- In vacuum oven method the temperature of sample drying is ____ for 72-96hrs .
- ____ & method is recognised as an official method for determination of moisture content.
- In chemical method of moisture determination _____ chemical is used as desiccant .
- The value of dry basis moisture content is _____ than the wet basis moisture content.
- In air oven method of moisture determination of grains are placed in oven at ____ for 1-2 hours .

Q. 2 True or false

- Drying is the removal of moisture to the bone dry conditions
- The moisture content of substance is usually expressed in percentage by weight.
- The electrical properties of grain are not temperature dependent .
- The unbound moisture content is more than the bound moisture content.
- Radiation drying method is generally used for drying of thin material .

Q. 3 Do as directed

- Enlist the mechanical drying methods.
- Define dehydration
- Write the factors responsible for choosing the method of moisture content determination.
- Define contact drying
- Enlist the direct method of moisture determination.

Answer Key (Lecture No. 10, 11 & 12)

Q. 1. Fill in the blanks.

- 100°C
- Brown duvel fractional distillation
- CaCl₂
- More
- 130°C

Q. 3

- False
- True
- False
- True
- True

Q. 5

- a) Contact drying ,convection drying,radiation drying
- b) Removal of moisture to very low levels usually to bone dry condition.
- c) The relative amount of water present,accuracy of method,the cost of equipment used.
- d) When the heat for drying is transferred to the wet solid mainly by conduction through a solid surface,the phenomenon known as contact drying .
- e) Air oven method,vaccum oven method,infra red method .

Lecture No. 14,15

Commercial Grain Dryers

Q. 1. Fill in the blanks.

- Recirculatory batch dryer is continuous flow..... Type of dryer
- Step typ solar dryer has a collector area of about.....
- Baffle and LSU dryer are Flow mixing dryer
- Dryer is most popular in india
- The grain temperature during drying should not exceed.....

Q. 2. Match the pairs

- | | |
|--------------------|--|
| a) Baffle dryer | i) Deep dryer |
| b) Solar dryer | ii) Non mixing type |
| c) LSU dryer | iii) Type and model step type |
| d) RPEC dryer | iv) Mixing type |
| e) Deep bed drying | v) Louisiana state university
Baton rouge USA in 1949 |

Q. 3. True or false

- Tray type dryer are useful when production rate is large
- In deep drying the rate of moisture removal is maximum for the bottom layer
- Recommended air flow rate is 60/M3/min/tonne of dry paddy
- RPEC dryer was developed at Rice Processing Engineering center,IIT Kharagpur
- Recirculatory batch dryer (RPEC dryer) is continuous flow of mixing type of dryer

Q. 4. Choose correct option

- Tya) Which dryer are used for fruit and vegetables
- | | |
|-------------------|----------------|
| i) Solar dryer | ii) Tray dryer |
| iii) Baffle dryer | iv) LSU dryer |
- b) Dryer was developed at Louisiana state university
- | | |
|-------------------|-----------------|
| i) LSU dryer | ii) RPEC dryer |
| iii) Baffle dryer | iv) Solar dryer |
- c) The recommended drying air temperature is.....
- | | |
|------------|-----------|
| i) 500°C | ii) 400°C |
| iii) 600°C | iv) 200°C |
- d) The multi track step type dryer can hold..... aluminium trays at a time
- | | |
|---------|-------------------|
| i) 20 | ii) 30 |
| iii) 10 | iv) None of these |
- e) Is a continuous flow mixing type of grain dryer
- | | |
|-------------------|-------------------|
| i) Solar dryer | ii) Tray dryer |
| iii) Baffle dryer | iv) None of these |

Q. 5. Do as directed

- Who developed the recirculatory batch dryer

- b) Write down function of solar dryer
- c) Define drying front
- d) Write down main advantage of the baffle dryer
- e) Define drying

Answer Key (Lecture No. 14 & 15)

Q. 1. Fill in the blanks.

- a) Non mixing
- b) 4.32 m²
- c) Continuous
- d) LSU
- e) 400°C

Q. 2

- a) Mixing type
- b) Type and model step type
- c) Louisiana state university
Baton rouge USA in 1949
- d) Non mixing type
- e) Deep layer

Q. 3

- a) False
- b) True
- c) False
- d) True
- e) False

Q. 4

- a) Solar dryer
- b) LSU dryer
- c) 600°C
- d) 10
- e) Baffle dryer

Q. 5

- a) The dryer was developed at Rice Processing Engineering centre (RPEC) ,IIT Kharagpur
- b) Drying of fruit, vegetables and agriculture commodities
- c) The upper edge of the drying zone at the interface with the wet zone is called as drying front
- d) The main advantage of dryer is uniformly dried product is obtained
- e) Drying is a removal of moisture from grains and other products to a predetermined level

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Lecture No. 16

Material Handling Equipments

Q. 1. Fill in the blanks.

- a) In belt conveyer belt may be flat for transporting bagged material orshaped.
- b) Generally grain conveying ,belt speed isis recommended.
- c) Screw conveyer consists of tubular or ...shaped.
- d) The capacity ofshould match with capacity of processing unit
- e) Transportation of grain belt speed should not be increase

Q. 2. Match the pairs

- | | |
|-------------------------------|------------------------------------|
| a) Bucket elevator | i) 10 cm |
| b) Belt conveyer | ii) High speed elevator |
| c) Spaced bucket elevator | iii) 2 to 1000t/ha |
| d) Continuous bucket elevator | iv) Super capacity bucket elevator |
| e) Diameter of screw | v) 2.5 to 2.8 m/s |

Q. 3. True or false

- a) Initial cost of belt conveyer is high for short distance .
- b) Transportation of grain belt should not be increased 3.5m/s.
- c) Screw conveyer required low pressure
- d) Capacity of bucket elevator is vary from 2 to 2000t/ha
- e) Buckets are enclosed in a single housing called leg

Q. 4. Choose correct option

- | | | |
|---|--------------------------|-------------------------|
| a) Shape of belt conveyer | i) U | ii) Tubular |
| | iii) V | iv) Non of these |
| b) Shape bucket elevator classified into..... | i) Centrifugal discharge | ii) High speed elevator |
| | iii) Positive discharge | iv) All of these |
| c) Shape of screw conveyer | i) V | ii) U |
| | iii) L | iv) Non of these |
| d) Odd mean out from following | i) Solar dryer | ii) Belt conveyer |
| | iii) Screw conveyer | iv) All of these |
| e) Conveyer and elevator are used forhandling | i) Seed | ii) Fertilizers |
| | iii) Grain | iv) Machine |

Q. 5. Do as directed

- a) Give types of conveyer.

- b) Belt conveyer consist of
- c) Bucket elevator classified into two types write it.
- d) Screw basically consists of
- e) Write the use of screw conveyer

Answer Key (Lecture No. 16)

Q. 1. Fill in the blanks.

- a) V Shaped
- b) 2.5 to 2.8 /s
- c) U shaped
- d) Handling conveying equipment
- e) 3.5 m/ s

Q. 2

- a) 2 to 1000 T/ha
- b) 2.5 to 2.8 m/s
- c) High speed elevator
- d) Super capacity bucket elevator
- e) 10 cm

Q. 3

- a) True
- b) True
- c) False
- d) False
- e) True

Q. 4

- a) V shaped
- b) All of these
- c) U shaped
- d) Solar dryer
- e) Grain

Q. 5

- a) 1. Belt conveyer
2. Screw conveyer
- b) Belt ,drive mechanism &end pulley idlers &loading &discharge devices.
- c) 1. Spaced bucket elevator
2. Continuous bucket elevator
- d) Shaft &screw blade or flight
- e) For grain handling facility ,animal feed industry ,other installations for conveying of products generally for short distance

