EBD

2006

AGRICULTURAL ENGINEERING - I (Optional)

000009

Standard : Degree **Total Marks : 200**

Nature : Conventional **Duration : 3 Hours**

Note :

(i) *Answers must be written in* ***English.***

(ii) *Question* ***No. 1*** *is* ***Compulsory.*** *Of the remaining questions, attempt* ***any four*** *selecting one question from* ***each section.***

(iii) *Figures to the* ***RIGHT*** *indicate marks of the respective question.*

(iv) *Use of log table, Non-Programmable calculator is permitted, but any other Table/Code/Reference book are not permitted.*

(v) *Make suitable assumptions, wherever be necessary and state the same.*

(vi) *Number of optional questions upto the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed.*

(vii) *Credit will be given for orderly, concise and effective writing.*

(viii) *Candidate should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he will be penalised.*

(ix) *For each slab of 10 and 15 marks, the examinee is expected to write answers in 125 and 200 words respectively.*

1. ***Answer any four of the following questions :***

(a) What is the difference between sorting and grading ? Derive the screen effectiveness and cleaning efficiency calculation equations. Explain the working of spiral and indented cylinder separators. **10**

(b) Explain the lateral pressure calculation in a storage bin using Airy and Janssen formulae. Explain the construction and working of green house dryer. **10**

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(c) Write down the step by step procedure to be followed for the calibration of a seed drill. **10**

(d) Draw a neat sketch of a box type solar cooker and label its parts. Write down its design principle briefly. **10**

(e) A two-bottom, 50 cm mould board plough is working at a depth of 15 cm. Calculate the unit draft, actual power required and actual field capacity if the draft is 14 kN. Take the speed of the tractor as 5.0 km/hr and field performance index as 0.75. **10**

SECTION - A

2. ***Answer the following sub-questions :***

(a) What is Equilibrium moisture content ? How it is determined by EMC models of Henderson and PET equations ? How the moisture content will be determined ? What is the dry basis moisture content value of 14% wet basis moisture content ? **10**

(b) Explain the construction advantages and working of LSU (Louisiana State University) drier. Explain any one of the Batch driers. **10**

(c) Explain the physical characteristics of roundness, sphericity, surface area and porosity. Explain thermal conductivity and diffusivity. **10**

(d) What is terminal velocity, derive its equation to calculate the same. Explain the three Rheological flow behaviors. **10**

3. ***Answer the following sub-questions :***

(a) Explain the different psychrometric properties. Explain how the psychrometric chart will be read for a given dry bulb temperature for humidity, RH and wet bulb temperature. **10**

(b) What are important things to be considered to design a dryer. Explain about Rotary and Solar cabinet dryer. **10**

(c) Explain about important mechanical properties will be measured for agricultural materials. Explain the electrical and dielectric properties. **10**

(d) What is drag coefficient ? What is the study of rheology ? **10**

Explain the construction and working of bucket elevator.

In a screw conveyor design, how the capacity m^3/h and horse power will be determined.

Marks

SECTION - B

4. *Answer the following sub-questions :*

(a) Write the equation to calculate the heat transfer by conduction. What is HTST and UHT pasteurization ? Explain the construction and working of shell and tube heat exchanger. **10**

(b) How the vapour compression refrigeration system works ? Find the cooling load expressed in tone of refrigeration which is caused by heat loss from the four side walls of a small cold room 2.4 m × 3.0 m × 2.4 m. The walls made of 20 cm brick, 20 cm cork board and 1.25 cm cement. Inside all temperature is 21°C. The safety factor is 2 to cover the loss of heat through duct and joints. Respective thermal conductivities of brick, cork and cement plaster are 0.6, 0.04 and 0.8 W/m°C. **10**

(c) Explain about stanchion and loose housing dairy barn construction details. What are all the important things should be taken into account for farm house design ? **10**

(d) Explain the Kick's law to calculate the power requirement for size reduction. Explain the working of Jaw and Gyratory crushers. What is the power required to crush 100 t/h of limestone of the feed size of 50.8 mm and the product size of 3.2 mm and the Rittinger's constant is 3.8. Use Rittinger's law. **10**

5. *Answer the following sub-questions :*

(a) Write the law of conservation of energy and mass. How the spray and freeze dryer works, explain. What are the two types of evaporators ? Explain working of rising and falling film evaporators. **10**

(b) What is precooling ? Explain controlled atmosphere storage. How it is enhancing the shelf life of horticultural produce ? Explain the sequence of unit operations in fruit processing. **10**

(c) Explain about various farm fencing systems. Describe the construction of milking parlor and pen barn. Explain the wire floored and deep litter type poultry houses. **10**

(d) What are the different size reduction mechanisms. Explain Bond's law for energy requirement calculation. Explain the principle and operation of attrition and ball mills. **10**

Marks

SECTION - C

6. *Answer the following sub-questions :*

(a) In Indian Agriculture draught animal power still continues to be an important source of farm power. Justify the statement with correct and recent data. **10**

(b) Draw neat sketch of simple, down draught, float type carburettor and label its parts. Write down its working principle. **15**

(c) Write down different parts of an axial flow thresher. Describe the general working principle of a thresher. List out its five important adjustments. **15**

7. *Answer the following sub-questions :*

(a) Draw the p-v diagram of air standard Otto cycle and derive an expression for the thermal efficiency in terms of compression ratio (r) and adiabatic index (γ). **10**

(b) Draw the schematic diagram of differential unit of a tractor transmission system and label its parts. Explain its working principle. **15**

(c) Classify tractor drawn disc harrows. Write down its different components with function briefly. **15**

SECTION - D

8. *Answer the following subquestions :*

(a) Power is transmitted using a V-belt drive. The included angle of V-groove is 30°. The belt is 20 mm deep and maximum width is 20 mm. If the mass of the belt is 0.35 kg/metre length and maximum allowable stress is 1.4 MPa, determine the maximum power transmitted when the angle of lap is 140°, $\mu = 0.15$. **15**

(b) Find the draft, side draft, vertical component of a pull of 20 kN when the line of pull makes an angle of 25° with horizontal and lies in the vertical plane which is at an angle of 15° with the direction of motion. Find also the draw bar power required to move the implement at a speed of 4 km/hr. **10**

(c) Write down the important factors to be considered for the selection of site to install wind energy conversion system on a commercial scale basis. Describe each factor briefly. **15**

Marks

9. *Answer the following sub-questions :*

(a) Write down the ergonomical considerations in the design of a push / pull type of manual weeder. **15**

(b) Write down the design considerations of a bullock-drawn seed drill. **10**

(c) Classify bio-mass gassifiers as per (i) direction of gas flow (ii) output of gassifiers and (iii) type of beds. Draw the schematic diagram of a down draught gassifier and write down its working principle. **15**

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