53 (FPT 503) FPEN

2013

(December)

FOOD PROCESS ENGINEERING

Paper : FPT 503

Full Marks : 100

Pass Marks : 30

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions out of **seven.***

INSTRUCTIONS :

* *Illustrate your answers with suitable sketches and examples wherever necessary.*
* *Make suitable assumption(s) wherever applicable.*
* *Preferably, write the answers in sequential order.*
* *Refer, Psychrometric chart for Qn. No. 1.*

1. *(a)* Represent the following psychrometric process in psychrometric chart 10

   (i) Heating of dehumidifying

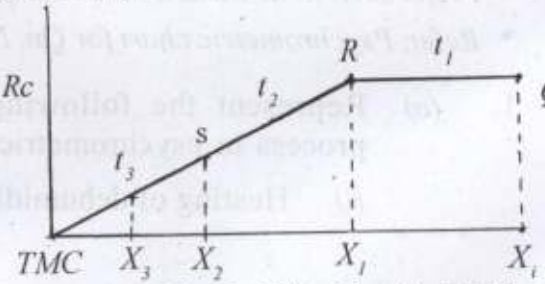
(ii) Drying of Food materials

(iii) Adiabatic mixing of two air-streams

(iv) Sensible heating.

(b) A grain dryer requires 300 m^3/min of heated air at 45^0C. The atmospheric air is at 24^0C and 80% relative humidity. Calculate the amount of heat required per hour to raise the air temperature from 24^oC to 45^oC. Check the answer with the help of the psychrometric chart. 10

2. (a) A batch of wet solid whose drying rate curve is represented by following figure is to be dried from 0.40 *kg* water per *kg* dry solids to 0.10 *kg* water per *kg* dry solids in 2 hours with constant air conditions. If the EMC=2% *(db)* calculate the total time required from 40% to 4% moisture content *(db)*. 10



X_i=40%, X_1=X_c=15%, X_2=10%, X_3=4%, EMC=2%

(b) Determine the values of 'C' & 'n' from Hendenson's equation for the following data :

Case-I RH = 40%, t=60°C , M_e= 8.65%

Case-II RH =80%, t=60°C, M_e=14.62%

10

3. (a) The observations were recorded during moisture content measurement of paddy by air oven method. Determine the moisture content of paddy on dry & wet basis with following observation 10

S. No.	wt. of moisture box *(MB) (gm)*	wt. of MB+Paddy *(gm)*	Wt. of MB + Paddy after drying
1	17.445	42.445	37.208
2	16.830	41.830	34.226

(b) During evaluation of an air screen grain cleaner with of 2 screens 250 *gm* samples were collected for analysis of clean seed fraction from different outlets. Calculate the cleaning efficiency, referring following data 10

Sample Fraction	Feed *(gm)*	Clean grain outlet *(gm)*	Blower outlet*(gm)*	Oversize Outlet *(gm)*	Under size Outlet *(gm)*
Cleaned seed	231.25	246.5	1.25	4.5	2.0
Impurities	18.75	3.5	248.75	245.5	248.0

4. (a) How evaporation is different from distillation & drying ? 5

(b) Describe a falling film evaporator system with neat diagram. 10

(c) What are the various applications of evaporation in Food Processing ? 5

5. (a) Describe how Bond's law scores over two grinding laws. 6

(b) What are various screening equipment you use in food processing ? 4

(c) 207 *KW* of power is required to crush 150 *t/h* of a material. If 80% of the feed passes through a 50*mm* screen of 80% of the product passes through a 3*mm* screen, calculate the work index of the material. And what will be the power required for the same feed at 150*t/h* to be crushed to a product such that 80% is to pass through a 1.5*mm* screen ? 10

6. Write short notes on : 5×4=20

(a) Soxlet extraction process

(b) Plate & Frame Filter press

(c) Reverse Osmosis

(d) Impellers

(e) Water activity.

7. Differentiate the following : 4×5=20

(a) Thin layer drying and Deep-bed drying

(b) Distillation and Evaporation

(c) Extraction and Decoction

(d) Single stage evaporator and multi-stage.
