B.TECH. DEGREE EXAMINATIONS: NOVEMBER 2009

Fourth Semester

BIOTECHNOLOGY

U07BT402: Unit Operations

Time: Three hours

Maximum Marks: 100

Answer ALL the Questions:-

PART A (10 x 1 = 10 Marks)

1. Which part of agitator will prevent swirling motion and vortex formation?

   A) Impeller   B) Shaft   C) Baffles   D) Diffuser

2. What type of impeller is used in a boat?

   A) Propeller   B) Turbine   C) Both   D) None

3. Which one of the following is batch sedimentation equipment?

   A) Dust catcher   B) Filter thickener   C) Cyclone separator   D) Rotary spray scrubber

4. Which of the following is a vacuum filter?

   A) Plate and Frame   B) Rotary drum filter   C) Sand filter   D) Batch basket centrifuge

5. An insulator should have

   A) High thermal conductivity   B) Low thermal conductivity

   C) Less resistance to heat flow   D) a porous structure

6. What is the unit for heat transfer?

   A) $BTU/hr.ft^2 \, {}^{o}F$ B) $BTU/hr. \, ft \, {}^{o}F$ C) $BTU/hr. \, {}^{o}F$ D) $BTU/hr.ft$

7. When vaporization takes place directly at the heating surface, it is called

   A) Film boiling   B) Nucleate boiling   C) Vapour binding   D) none

8. Dropwisw condensation occurs on ----- surface

   A) Clean and dirt free   B) Contaminated cooling   C) Smooth clean   D) Polished

9. Evaporator tubes are generally

   A) Vertical   B) Horizontal   C) inclined   D) random

10. Double pipe heat exchanger are used

    A) When the heat transfer area required is very high

    B) When the heat transfer area required is very low

    C) because it occupies less floor area

    D) Because it is less costly

PART B (10 x 2 = 20 Marks)

11. What is the significance of Flow number in agitation?

12. How will you choose the repeating variables in dimensional analysis?

13. Write the unit for specific cake and filter medium resistance.

14. Define terminal settling velocity.

15. What is the driving force and resistance for heat transfer?

16. How will you calculate heat loss through an insulating wall?

17. State natural convection heat transfer with example.

18. Write the relation between electrical circuit and lumped heat capacity analysis.

19. What is the effect of temperature and steam pressure in evaporation operation?

20. What is meant by the term BWG in a heat exchanger?

PART C (5 x 14 = 70 Marks)

21 (a) i) With a neat sketch explain the working principle of Ban bury mixer. (7)

  ii) Explain the applications of Dimensional Analysis. (7)

(OR)

(b) i) Explain the general procedure for Buckingham Theorem method used in Dimensional Analysis. (10)

  ii) Without any moving parts explain the mixing process of two fluids (4)

22 (a) i) Derive an expression for α and Rm for constant pressure and constant volume filtration process. (10)

  ii) Explain with a neat sketch the various zones in a rotary drum filter. (4) (i

(OR)

(b) i) Define terminal settling velocity. (2)

  ii) Derive the terminal settling velocity by differential settling method (12)

23 (a) i) Derive an expression for temperature distribution for a solid initially at a temperature to which is placed in a convective environment at temperature Tα for a process in which internal resistance is ignored. (10)

  ii) Explain the term "Newtonian heating". (4)

(OR)

(b) i) A hollow sphere has an inside surface temperature 300°C and the outside surface temperature of 30°C. Calculate the heat loss by conduction for an inside diameter 15 cm. The thermal conductivity of the material is 15kcal / hr.m °C. Also derive expression used for the above calculation.

  ii) Explain the significance of Biot number.

24. (a) Derive from fundamentals by dimensional analysis the relation between dimensionless numbers for natural convection heat transfer.

(OR)

(b) i) Write short notes on (9)

(1) Pool boiling (2) Nucleate boiling (3) Transition boiling

ii) Explain the convection in flow over surfaces through pipes mentioning the friction factor. (5)

25. (a) i) Write the material and energy balance for single effect evaporater. (10)

ii) State and explain Duhring's rule in evaporator. (4)

(OR)

(b) i) A double pipe heat exchanger is cooled with water flowing in the outer pipe with ethyl alcohol flowing in the inner pipe. The inside and outside diameter of the inner pipe are 2.6cm and 3.5cm .The thermal conductivity of the steel is 26cal/cm.hr°C.The individual film coefficient and fouling factors are (10)

Data:

Alcohol coefficient = 180 kcal/hr.m^2°C.

Water coefficient = 300

Inside fouling factor = 1000

Outside fouling factor = 500

Calculate the overall coefficient based on the outside area of the inner pipe.

(ii)Explain the role of baffles and Tie rods in heat exchanger. (4)

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