

B.Tech. Sixth Semester (Food, P & P, O & P and Petro. Tech.) (CGS)
11051 : Pulp & Paper Technology - III : Paper - 6 PT 04

P. Pages : 3

Time : Three Hours



AU - 2817

Max. Marks : 80

- Notes :
1. Due credit will be given to neatness and adequate dimensions.
 2. Assume suitable data wherever necessary.
 3. Diagrams and chemical equations should be given wherever necessary.
 4. Illustrate your answer necessary with the help of neat sketches.
 5. Use of slide rule logarithmic tables, Steam tables, Moller's Chart, Drawing instrument, Thermodynamic table for moist air, Psychrometric Charts and Refrigeration charts is permitted.
 6. Discuss the reaction, mechanism wherever necessary.
 7. Duhring Rule and Enthalpy concentration chart permitted.

SECTION - A

1. a) A horizontal belt pulp washer is processing 300.0 Tonnes per day of O.D. pulp. The length of workable surface of the belt washer is 5.0 m while it's width is 4.0 m. Calculate the washer loading. **4**
b) If you don't wash chemical pulp after blowing then which difficulties would you face? **4**
c) Explain the role played by flexibility of pulp particles which affect rejection in a screen. Draw a graph to prove your point. **5**

OR

2. a) How does fiber mat theory explain the screening operation? **5**
b) Explain the mechanism of Vacuum formation in dropleg type of rotary drum washers. **4**
c) What do you understand by dilution factor of pulp washer? Normally for washers how much dilution factor is kept? If dilution factor is increased to 7 what would happen? **4**
3. a) An evaporator is used to concentrate 4536 Kg/Hr of 10.0% solution of sodium hydroxide in water entering at 60°C to a product of 50.0% (wt %) solids solution. The pressure of saturated steam used is 200 kPa and the pressure in vapour space is maintained at 20.0 kPa. The overall heat transfer coefficient of evaporator is $1560 \text{ W/m}^2 \cdot \text{K}$. Calculate the steam economy, steam consumption and heating surface are in m^2 . **9**
b) Where paper industry uses forced circulation evaporator to concentrate black liquor? Explain the benefits of using forced circulation evaporator. **4**

OR

4. a) How do you measure the density and specific gravity of black liquor? What role does these two parameters play in the concentration of black liquor? **4**

- b) Draw a four stage counter flow multiple effect feed arrangement showing clearly the feed, concentrated liquor coming out and vapour flow sequence. 5
- c) Why falling film evaporator is preferred as compared to climbing film? 4
5. a) What role does super heater play in the recovery furnace? Explain the design of super heater tubes. 5
- b) If Chloride and potassium ions are present in the smelt then what problems would you face? 5
- c) Why do you add sodium sulphate to the black liquor before it is fired inside the recovery furnace? 4

OR

6. a) Why residual sodium oxide content of lime mud feed is measured before lime is sent for calcination? 4
- b) What are the various fuels used in lime film for lime reburning? 3
- c) Why causticization reaction has to be completed in three or more stages in causticizer? 7

SECTION - B

7. a) A single effect evaporator is being used to concentrate sulfite black liquor. The feed is entering at 54.0°C (327 K) and concentration of feed is 15.0% (wt %). The concentrated liquor is being removed at 45.0% (wt %). Saturated steam is entering in the evaporator at 160.0 kPa and pressure in vapour space is maintained at 15.0 kPa. Specific heat of sulfite black liquor was 2.77 kJ/kg. °C and overall heat transfer coefficient was observed to be 1560 W/m². °C. Neglecting boiling point rise, radiation losses calculate the steam consumption, steam economy and heat transfer area of evaporator. 5
- b) Explain with the help of flow diagram the chemical recovery process of sodium base sulfite spent liquor. 8

OR

8. a) How is alcohol manufactured from sulfite spent liquor? 6
- b) Write down the elemental analysis of sodium base sulfite spent liquor. 4
- c) How is black liquor of sulfite pulping process fired in the chemical recovery furnace? 3
9. a) Why is bleaching of chemical pulp a multistep process? 3
- b) Why during bleaching of pulp by chlorine, chlorine dioxide, ozone and oxygen upflow towers are used but while bleaching with hydrogen peroxide, hypochlorite alkali extraction down flow towers are used? 3
- c) A pulp has a Kappa Number of 30. If the actual chlorine required to bleach the pulp is obtained by dividing the oxidizing power of potassium permanganate by 0.65. Calculate the chemicals required for bleaching 2.0 tonnes of over dry pulp if you are using chlorine, calcium hypochlorite having 35.0% available chlorine and ozone. 7

OR

10. a) With the help of operating parameters explain chlorine dioxide bleaching of pulp. 4
- b) Which chemicals are responsible for bleach plant corrosion? What precautions would you take to prevent corrosion? 4
- c) What do you understand by particle bleaching of pulp? Which chemical does best particle bleaching? 5
11. a) If nearly 100.0% bleached yield is required which type of pulp bleaching would you undertake? Name the bleaching chemicals used for such bleaching. 4
- b) What do you understand by elemental chlorine free bleaching (ECF) of pulp? Write down the bleaching sequence used for such bleaching. What are the advantages of ECF bleaching? 4
- c) What is the role played by consistency of pulp in ozone bleaching? At what consistency is ozone bleaching undertaken? 6

OR

12. a) Write down the process conditions of using hydrogen peroxide bleaching of chemical pulp? Why hydrogen peroxide is preferred in modern conditions? 6
- b) What do you understand by Adsorbable Organic Halides (AOX)? Where are AOX produced in paper mill? 6
- c) In brief write down the toxicological effect of AOX on fishes. 2

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