

Total number of printed pages – 4

B. Tech
CPEV 7304

Sixth Semester Examination – 2008

UNIT OPERATION AND PROCESSES

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory
and any **five** from the rest.

The figures in the right-hand margin
indicate marks.

1. Answer the following questions : 2×10
- (a) State why centrifuging is not desirable in ball mill ?
 - (b) Define filtration and state factors affecting rate of filtration.
 - (c) What do you mean by thermal conductivity ? Give its unit.



- (d) For double pipe heat exchanger give equivalent diameter in terms of D_1 and D_2 , where D_1 is the outside diameter of inside pipe and D_2 is the inside diameter of outside pipe.
 - (e) Define forced convection and give suitable example of it.
 - (f) Give mathematical statement of Fick's law of diffusion and explain the meaning of each terms involved in it.
 - (g) A wet solid is to be dried from 80% to 5% moisture on wet basis. Calculate the amount of moisture to be evaporated per 100 kg of dried product.
 - (h) Name different bioprocess units involved in wastewater treatment.
 - (i) What is the difference between aerobic and anaerobic biological process.
 - (j) State the methods of avoiding vortex in agitated vessel.
2. (a) Write in brief about the construction and operation of ball mill. 5

P.T.O.

CPEV 7304

2

Contd.

- (b) A certain crusher accepts a feed material having a volume-surface mean diameter of 19 mm and gives a product of volume-surface mean diameter of 5 mm. The power required to crush 15 tonnes per hour is 7.5 kW. What will be the power consumption if the capacity is reduced to 12 tonnes per hour ? 5
3. With a neat diagram explain the construction and working principle of a mechanically agitated thickener. 10
4. A furnace is constructed with 229 mm thick of fire brick, 115 mm of insulation brick and again 229 mm of building brick. The inside temperature is 1223 K and the temperature at the outermost wall is 323 K. The thermal conductivities of fire brick, insulating brick and building brick are 6.05, 0.581 and 2.33 W/(m.K). Find the heat lost per unit area and temperature at the interface. 10
5. Describe in detail about dropwise condensation and filmwise condensation. What is the difference between them and which type of condensation is desirable ? Also explain the effect of non condensable gases on condensation. 10
6. In an oxygen–nitrogen gas mixture at 101.3 kPa and 298 K, the concentrations of oxygen at two phases 2 mm apart are 10 and 20% by volume respectively. Calculate the flux of diffusion of oxygen for the cases where :
- (a) the nitrogen is non-diffusing
- (b) there is equimolar counter diffusion of two gases.
- Diffusivity of oxygen in nitrogen is $1.8110^{-5} \text{ m}^2/\text{s}$. 10
7. Describe in detail about various upstream and downstream unit operations involved in an integrated bioprocess. 10
8. Write short note on any two : 5×2
- (a) Mixing
- (b) Distillation
- (c) Adsorption
- (d) Ion exchange.