B.E./B.TECH. Degree Examination, December 2020

Fourth Semester

BT16403- HEAT AND MOMENTUM TRANSFER OPERATIONS

(Regulation 2016)

Time: Three hours   Maximum : 80 Marks

Answer ALL questions

PART A - (8 X 2 = 16 marks)

1. Unit of the rate of heat transfer is

   a) Joule b) Newton c) Pascal d) Watt

2. LMTD in case of counter flow heat exchanger as compared to parallel flow heat exchanger is

   a) Higher b) Lower c) Same   d) Depends on the area of heat exchanger

3. Which of the following is not the component of aeration and agitation system?

   a) Impeller b) Baffles c) Stirrer gland and bearing d) Thermometer

4. The main function of centrifugal pumps are to

   a) Transfer speed b) Transfer pressure c) Transfer temperature d) Transfer energy

5. Give some examples of heat transfer in Biotechnology.

6. Sketch the flow arrangements of a cross flow heat exchanger

7. What are the uses of dimensional analysis?

8. What is fouling? Why fouling factors are taken into consideration while designing heat transfer equipments?

PART B - (4 X16 = 64 marks)

09. (a) A furnace wall is made of 2 layers. The first inner layer is made up of refractory   (16)
        bricks of thickness 120 mm and thermal conductivity 0.14 W/mK, backed by a
        common brick of thickness 230 mm and thermal conductivity 1.4W/mK. the inner
        Temperature of the furnace wall is 750° C and the outer wall temperature is 75° C.

        a. What is the rate of heat flow through wall?

        b. What is the temperature of the interface between refractory brick and
           common brick?

(OR)

   (b) (i) Write short notes on lumped heat capacity analysis   (8)

       (ii) Explain briefly the usefulness of fins and indicate its different configurations   (8)

10. (a) (i) Discuss the concept of a black body   (8)

        (ii) Calculate the rate of heat transfer by radiation from a 1m length pipe of   (8)

60mm diameter at a temperature of 150ºC, to the surrounding at 27ºC. The emissivity of the pipe is 0.8.

(OR)

(b) With a neat sketch, explain the working of a U-tube heat exchanger (16)

11. (a) What are the different types of impellers used for agitating liquids? Give sketches. (16)

(OR)

(b) Discuss in detail the characteristics of Newtonian and non Newtonian fluids. (16)

12. (a) In a 1 - 1 counter flow shell and tube heat exchanger, a process stream (16) $[C_P = 4.2 \text{ kJ/(kg.K)}]$ is cooled from 450 to 350 K using water $[C_P = 4.2 \text{ kJ/(kg.K)}]$ at 300 K. The process stream flows on the shell-side at a rate of 1 kg/s and the water on the tube-side at a rate of 5 kg/s. If the heat transfer coefficients on the shell and tube sides are 1000 W/(m².K) and 1500 W/(m².K), respectively, Determine: (a) The required heat transfer area. b) By what factor will the required area change if the flow is concurrent? Neglect tube wall resistance and fouling resistances.

(OR)

(b) With a neat sketch explain the principle and working of a centrifugal pump. (16)