Code No: R05322303 **R05** **Set No. 2**

III B.Tech II Semester Examinations,December 2010
HEAT TRANSFER IN BIOPROCESSES
Bio-Technology

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Is it possible to achieve HTST sterilization in a batch process ? If so, how ? If not, why ? [16]

2. Air at 101.325 kPa and 300 K (27^0 C) blows across a 12 mm diameter sphere at a free stream velocity of 4 m/s. A small heater inside the sphere maintains the surface temperature at 350 K (77^0 C). Estimate the heat lost by the sphere.

   Data: The properties of air at the free stream temperature 300 K are:
   $\upsilon = 15.69 \times 10^{-6} m^2/s, k = 0.02624 W/(m.K)$,
   $N_{Pr} = 0.708$, $\mu = 2.075 \times 10^{-5} kg/(m.s)$, [16]
   At $T_w = 350K$, $\mu_w = 2.075 \times 10^{-5} kg/(m.s)$

3. Describe the working of a single pass shell-and-tube heat exchanger with a neat diagram. What are its applications in bioprocessing ? [16]

4. (a) How do you calculate the heat exchanger load in an evaporator?
   (b) How do you calculate the condenser load in an evaporator? [8+8]

5. (a) A wall of 0.5 m thickness is constructed using a material having thermal conductivity of 1.4 W/(m.K). The wall is insulated with a material having thermal conductivity of 0.35 W/(m.K) so that heat loss per m^2 is 1500 W. the inner and outer temperatures are 1273 K (1000^0 C) and 373 k(100^0 C) respectively. Calculate the thickness of insulation required and temperature of the interface between two layers.

   (b) A cylindrical tube has inner diameter of 20 mm and outer diameter of 30mm. find out the rate of heat flow from tube of length 5 m if inner surface is at 373 K (100^0 C) and outer surface is at 308 K (35^0 C). Take the thermal conductivity of tube material as 0.291 W/(m.K). [8+8]

6. Differentiate between film type condensation and dropwise dirensation with examples? [16]

7. A 10 cm x 10 cm square power board dissipates uniform flux of 6880 W/cm^2. Air at 25^0C is used to cool the board by forced convection on both sides. Design considerations limit the maximum surface temperature to 85^0C. Determine the required free stream air velocity. [16]

8. Write the advantages and disadvantages of batch and continuous sterilizers in the bio procers industry with examples? [16]

Code No: R05322303 **R05** **Set No. 2**

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Code No: R05322303 **R05** **Set No. 4**

III B.Tech II Semester Examinations,December 2010
HEAT TRANSFER IN BIOPROCESSES
Bio-Technology

Time: 3 hours **Max Marks: 80**

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All Questions carry equal marks

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3. (a) How do you calculate the heat exchanger load in an evaporator?
   (b) How do you calculate the condenser load in an evaporator? [8+8]

4. Is it possible to achieve HTST sterilization in a batch process ? If so, how ? If not, why ? [16]

5. Describe the working of a single pass shell-and-tube heat exchanger with a neat diagram. What are its applications in bioprocessing ? [16]

6. (a) A wall of 0.5 m thickness is constructed using a material having thermal conductivity of 1.4 W/(m.K). The wall is insulated with a material having thermal conductivity of 0.35 W/(m.K) so that heat loss per m^2 is 1500 W. the inner and outer temperatures are 1273 K (1000^0 C) and 373 k(100^0 C) respectively. Calculate the thickness of insulation required and temperature of the interface between two layers.

   (b) A cylindrical tube has inner diameter of 20 mm and outer diameter of 30mm. find out the rate of heat flow from tube of length 5 m if inner surface is at 373 K (100^0 C) and outer surface is at 308 K (35^0 C). Take the thermal conductivity of tube material as 0.291 W/(m.K). [8+8]

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Code No: R05322303 **R05** **Set No. 4**

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Code No: R05322303 **R05** **Set No. 1**

III B.Tech II Semester Examinations,December 2010
HEAT TRANSFER IN BIOPROCESSES
Bio-Technology

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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Code No: R05322303 **R05** **Set No. 1**

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Code No: R05322303 **R05** **Set No. 3**

III B.Tech II Semester Examinations,December 2010
HEAT TRANSFER IN BIOPROCESSES
Bio-Technology

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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Code No: R05322303 **R05** **Set No. 3**

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