Code No: RR310803 | RR | SET-1

B. Tech III Year I Semester Examinations, December - 2011
HEAT TRANSFER
(CHEMICAL ENGINEERING)

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

Answer any five questions
All questions carry equal marks
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1. Derive the general heat conduction equation in Cartesian system and hence deduce the expression for temperature distribution through a plane wall. [16]

2. Steam at 300^0C flows in a stainless steel pipe of thermal conductivity 30 W/mK whose inner and outer diameters are 5 cm and 5.5 cm respectively. The pipe is covered with 5 cm thick glass wool of thermal conductivity 0.038W/mK. Heat is lost to the surroundings at 20^0C by convection and radiation with a combined heat transfer coefficient of 15W/m^2K. Taking the inside heat transfer coefficient as 80W/m^2K, calculate the heat lost per metre length of the pipe. [16]

3.a) Distinguish between steady state conduction and unsteady state conduction.
b) A 3cm diameter aluminium sphere of thermal conductivity 204 W/mK, density 2700 kg/m^3, specific heat 0.896 KJ/kgK is initially at 175^0C. It is suddenly immersed in a well-stirred fluid at 25^0C. The temperature of the sphere is lowered to 100^0C in 42 sec. Calculate the heat transfer coefficient. [16]

4.a) What is entrance length and how do you find it for laminar and turbulent flow conditions through a tube.
b) Liquid mercury flows through a long tube of 2.5 cm inner diameter with a velocity of 1 m/sec. Calculate the heat transfer coefficient for the constant wall temperature boundary condition. Assume the following properties for mercury.
Density = 12,870 Kg/m^3, Viscosity = 0.000863 N-s/m^2
Specific heat = 0.134 KJ/KgK, Thermal conductivity = 14W/mK. [8+8]

5.a) What is the difference between heat transfer for liquid metal flow and ordinary fluids?
b) Air at 1atm and 27^0C flows across a cylinder of 2.5cm diameter with a velocity of 30m/sec. The cylinder surface is maintained at 120^0C. Calculate the mean heat transfer coefficient and heat transfer rate per metre length of the cylinder. If the air pressure is 2 atm, what is the heat transfer? [8+8]

6.a) Define Rayleigh number and explain its significance in natural convection.
b) A vertical plate of 0.3m height and 0.1m width maintained at a uniform temperature of 80^0C is exposed to ambient air at 25^0C. Calculate the heat lost from the plate. [8+8]

7.a) Compare horizontal and vertical condensation.
b) Describe horizontal tube evaporator with a neat sketch. [8+8]

8.a) Explain how good emitters can be treated as good absorbers.
b) A black solid cylinder of emissivity 0.95 and at 100^0C is kept concentrically in a large cylinder maintained at 30^0C, having emissivity 0.2. Calculate the radiation heat exchange between two surfaces per m^2 area. [8+8]

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Code No: RR310803 | RR | SET-2

B. Tech III Year I Semester Examinations, December - 2011
HEAT TRANSFER
(CHEMICAL ENGINEERING)

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

Answer any five questions
All questions carry equal marks

1.a) Distinguish between steady state conduction and unsteady state conduction.
b) A 3cm diameter aluminium sphere of thermal conductivity 204 W/mK, density 2700 kg/m^3, specific heat 0.896 KJ/kgK is initially at 175^{0}C. It is suddenly immersed in a well-stirred fluid at 25^{0}C. The temperature of the sphere is lowered to 100^{0}C in 42 sec. Calculate the heat transfer coefficient. [16]

2.a) What is entrance length and how do you find it for laminar and turbulent flow conditions through a tube.
b) Liquid mercury flows through a long tube of 2.5 cm inner diameter with a velocity of 1 m/sec. Calculate the heat transfer coefficient for the constant wall temperature boundary condition. Assume the following properties for mercury.
Density = 12,870 Kg/m^3, Viscosity = 0.000863 N-s/m^2
Specific heat = 0.134 KJ/KgK, Thermal conductivity = 14W/mK. [8+8]

3.a) What is the difference between heat transfer for liquid metal flow and ordinary fluids?
b) Air at 1atm and 27^{0}C flows across a cylinder of 2.5cm diameter with a velocity of 30m/sec. The cylinder surface is maintained at 120^{0}C. Calculate the mean heat transfer coefficient and heat transfer rate per metre length of the cylinder. If the air pressure is 2 atm, what is the heat transfer? [8+8]

4.a) Define Rayleigh number and explain its significance in natural convection.
b) A vertical plate of 0.3m height and 0.1m width maintained at a uniform temperature of 80^{0}C is exposed to ambient air at 25^{0}C. Calculate the heat lost from the plate. [8+8]

5.a) Compare horizontal and vertical condensation.
b) Describe horizontal tube evaporator with a neat sketch. [8+8]

6.a) Explain how good emitters can be treated as good absorbers.
b) A black solid cylinder of emissivity 0.95 and at 100^{0}C is kept concentrically in a large cylinder maintained at 30^{0}C, having emissivity 0.2. Calculate the radiation heat exchange between two surfaces per m^2 area. [8+8]

7. Derive the general heat conduction equation in Cartesian system and hence deduce the expression for temperature distribution through a plane wall. [16]

8. Steam at 300^{0}C flows in a stainless steel pipe of thermal conductivity 30 W/mK whose inner and outer diameters are 5 cm and 5.5 cm respectively. The pipe is covered with 5 cm thick glass wool of thermal conductivity 0.038W/mK. Heat is lost to the surroundings at 20^{0}C by convection and radiation with a combined heat transfer coefficient of 15W/m^{2}K. Taking the inside heat transfer coefficient as 80W/m^{2}K, calculate the heat lost per metre length of the pipe. [16]

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Code No: RR310803 | RR | SET-3

B. Tech III Year I Semester Examinations, December - 2011
HEAT TRANSFER
(CHEMICAL ENGINEERING)

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

Answer any five questions
All questions carry equal marks

1.a) What is the difference between heat transfer for liquid metal flow and ordinary fluids?

b) Air at 1atm and 27^0C flows across a cylinder of 2.5cm diameter with a velocity of 30m/sec. The cylinder surface is maintained at 120^0C. Calculate the mean heat transfer coefficient and heat transfer rate per metre length of the cylinder. If the air pressure is 2 atm, what is the heat transfer? [8+8]

2.a) Define Rayleigh number and explain its significance in natural convection.

b) A vertical plate of 0.3m height and 0.1m width maintained at a uniform temperature of 80^0C is exposed to ambient air at 25^0C. Calculate the heat lost from the plate. [8+8]

3.a) Compare horizontal and vertical condensation.

b) Describe horizontal tube evaporator with a neat sketch. [8+8]

4.a) Explain how good emitters can be treated as good absorbers.

b) A black solid cylinder of emissivity 0.95 and at 100^0C is kept concentrically in a large cylinder maintained at 30^0C, having emissivity 0.2. Calculate the radiation heat exchange between two surfaces per m^2 area. [8+8]

5. Derive the general heat conduction equation in Cartesian system and hence deduce the expression for temperature distribution through a plane wall. [16]

6. Steam at 300^0C flows in a stainless steel pipe of thermal conductivity 30 W/mK whose inner and outer diameters are 5 cm and 5.5 cm respectively. The pipe is covered with 5 cm thick glass wool of thermal conductivity 0.038W/mK. Heat is lost to the surroundings at 20^0C by convection and radiation with a combined heat transfer coefficient of 15W/m^2K. Taking the inside heat transfer coefficient as 80W/m^2K, calculate the heat lost per metre length of the pipe. [16]

7.a) Distinguish between steady state conduction and unsteady state conduction.

b) A 3cm diameter aluminium sphere of thermal conductivity 204 W/mK, density 2700 kg/m^3, specific heat 0.896 KJ/kgK is initially at 175^0C. It is suddenly immersed in a well-stirred fluid at 25^0C. The temperature of the sphere is lowered to 100^0C in 42 sec. Calculate the heat transfer coefficient. [16]

8.a) What is entrance length and how do you find it for laminar and turbulent flow conditions through a tube.

b) Liquid mercury flows through a long tube of 2.5 cm inner diameter with a velocity of 1 m/sec. Calculate the heat transfer coefficient for the constant wall temperature boundary condition. Assume the following properties for mercury.
Density = 12,870 Kg/m^3, Viscosity = 0.000863 N-s/m^2
Specific heat = 0.134 KJ/KgK, Thermal conductivity = 14W/mK. [8+8]

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Code No: RR310803 | RR | SET-4

B. Tech III Year I Semester Examinations, December - 2011
HEAT TRANSFER
(CHEMICAL ENGINEERING)

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

Answer any five questions
All questions carry equal marks

1.a) Compare horizontal and vertical condensation.
b) Describe horizontal tube evaporator with a neat sketch. [8+8]

2.a) Explain how good emitters can be treated as good absorbers.
b) A black solid cylinder of emissivity 0.95 and at 100^0C is kept concentrically in a large cylinder maintained at 30^0C, having emissivity 0.2. Calculate the radiation heat exchange between two surfaces per m^2 area. [8+8]

3. Derive the general heat conduction equation in Cartesian system and hence deduce the expression for temperature distribution through a plane wall. [16]

4. Steam at 300^0C flows in a stainless steel pipe of thermal conductivity 30 W/mK whose inner and outer diameters are 5 cm and 5.5 cm respectively. The pipe is covered with 5 cm thick glass wool of thermal conductivity 0.038W/mK. Heat is lost to the surroundings at 20^0C by convection and radiation with a combined heat transfer coefficient of 15W/m^2K. Taking the inside heat transfer coefficient as 80W/m^2K, calculate the heat lost per metre length of the pipe. [16]

5.a) Distinguish between steady state conduction and unsteady state conduction.
b) A 3cm diameter aluminium sphere of thermal conductivity 204 W/mK, density 2700 kg/m^3, specific heat 0.896 KJ/kgK is initially at 175^0C. It is suddenly immersed in a well-stirred fluid at 25^0C. The temperature of the sphere is lowered to 100^0C in 42 sec. Calculate the heat transfer coefficient. [16]

6.a) What is entrance length and how do you find it for laminar and turbulent flow conditions through a tube.
b) Liquid mercury flows through a long tube of 2.5 cm inner diameter with a velocity of 1 m/sec. Calculate the heat transfer coefficient for the constant wall temperature boundary condition. Assume the following properties for mercury.
Density = 12,870 Kg/m^3, Viscosity = 0.000863 N-s/m^2
Specific heat = 0.134 KJ/KgK, Thermal conductivity = 14W/mK. [8+8]

7.a) What is the difference between heat transfer for liquid metal flow and ordinary fluids?
b) Air at 1atm and 27^0C flows across a cylinder of 2.5cm diameter with a velocity of 30m/sec. The cylinder surface is maintained at 120^0C. Calculate the mean heat transfer coefficient and heat transfer rate per metre length of the cylinder. If the air pressure is 2 atm, what is the heat transfer? [8+8]

8.a) Define Rayleigh number and explain its significance in natural convection.
b) A vertical plate of 0.3m height and 0.1m width maintained at a uniform temperature of 80^0C is exposed to ambient air at 25^0C. Calculate the heat lost from the plate. [8+8]

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