I D NO.	

PRESIDENCY UNIVERSITY, BENGALURU

SCHOOL OF ENGINEERING

Weightage: 40% Max Marks: 40 Max Time: 2 hrs. 07 May 2018, Monday

END TERM FINAL EXAMINATION MAY 2018

Even Semester 2017-18 Course: **PET 206 Heat and Mass Transfer** IV Sem. Petroleum

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Instructions:

(i) *Read the question properly and answer accordingly.*
(ii) *Question paper consists of 3 parts.*
(iii) Scientific and Non-programmable calculators are permitted
(iv) Using *Heat and Mass transfer Data Book* by C P Kothandaraman is permitted.

Part A

(4 Q x 04 M = 16 Marks)

1. Water at the rate of 70 kg/min is heated from 35 to 75°C by an oil having a specific heat of 1.67 kJ/kg·°C. The fluids are used in a counter flow double-pipe heat exchanger, and the oil enters the exchanger at 110°C and leaves at 75°C. The overall heat-transfer coefficient is 300 W/m^2·°C. Calculate the heat-exchanger area.

2. Calculate the net radiant heat exchange between two coaxial parallel disks separated by a distance of 200mm. One disc is having a diameter of 500mm and maintained at temperature of 1500 °C. Another disc is having a diameter of 400 mm and maintained at 575 °C.

3. Air at 2 atm and 220°C is heated as it flows through a tube with a diameter of 1 in (2.54 cm) at a velocity of 15 m/s. Calculate the heat transfer per unit length of tube

if a constant-heat-flux condition is maintained at the wall and the wall temperature is 25°C above the air temperature, all along the length of the tube.

4. Define the following:
   i. Thermal radiation
   ii. Black body
   iii. Gray body
   iv. Specular and diffuse in terms of reflection

Part B

(2 Q x 07 M = 14 Marks)

5. What is distillation? Explain any two types of distillation.

6. Hot water at 120°C flows through a 3-in schedule 40 horizontal steel pipe [k =54 W/m·°C] and is exposed to atmospheric air at 18°C. The water velocity is 28 cm/s. Temperature at the outside wall of pipe is 100°C. Calculate the overall heat transfer coefficient for this situation, based on the outer area of pipe.

Part C

(1 Q x 10 M = 10 Marks)

7. Water at the rate of 4 kg/s is heated from 38 to 55°C in a shell-and-tube heat exchanger. On the shell side one pass is used with water as the heating fluid, 2 kg/s, entering the exchanger at 94°C. The overall heat-transfer coefficient is 1420 $W/m^2.°C$, and the average water velocity in the 1.905-cm diameter tubes is 0.4 m/s. Because of space limitations, the tube length must not be longer than 2.5 m. calculate the number of tube passes, the number of tubes per pass, and the length of the tubes, consistent with this restriction.

ID NO:	

PRESIDENCY UNIVERSITY, BENGALURU

SCHOOL OF ENGINEERING

Weightage: 20% Max Marks: 20 Max Time: 1 hr. 26 March Monday 2018

TEST – 2 **SET A**

Even Semester 2017-18 Course: **PET 206 Heat and Mass Transfer** IV Sem. Petroleum

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Instruction:

(i) Read the question properly and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted.
(iv) Using *Heat and Mass transfer Data Book* by C P Kothandaraman is permitted.
(v) Using Heisler Charts is allowed.

Part A

(2Q = 06 Marks)

1. In the context of unsteady state heat transfer, what is 'Lumped capacity analysis'?

(02 Marks)

2. Two parallel pipes 5 cm and 8 cm in diameter are totally surrounded by loosely packed asbestos. The distance between centers for the pipes is 15 cm. One pipe carries steam at 110°C while the other carries chilled water at 3°C. Calculate the heat lost by the hot pipe per unit length. (04 Marks)

Part B

(1 Q x 7 M = 07 Marks)

3. A large ice slab with thickness 10 cm is initially at a uniform temperature of −22°C. If the outside surface is suddenly exposed to convection environment of −2°C and 20 W/m^2 °C, calculate the temperature at a depth of 2.5 cm after 1 min. The properties of ice are ρ=914 Kg/m^3, Cp =1925 J/Kg K, k =2.215 W/m K, α=1.24*10^{-6} m^2/s. How much energy has been removed per unit area from the slab in this time?

Part C

(1 Q x 7 M = 07 Marks)

4. Obtain the temperatures for nodes 1, 2, 3 and 4 as shown in Figure 1 by using numerical method technique. Also find the amount of heat transferred at each faces.

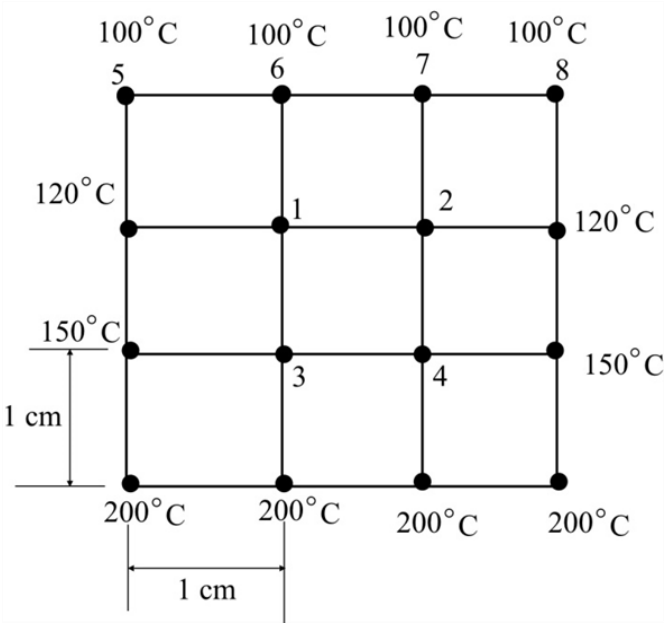

Figure 1

ID NO:	

PRESIDENCY UNIVERSITY, BENGALURU

SCHOOL OF ENGINEERING

Weightage: 20 % Max Marks: 20 Max Time: 1 hr. 21 Feb Wednesday 2018

TEST – 1

Even Semester 2017-18 Course: **PET 206 Heat and Mass Transfer** IV Sem. Petroleum

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Instruction:

(i) Read the question properly and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted.
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Part A

(2 Q x 3 M = 06 Marks)

1. What is thermal Conductivity of a material? Explain its significance.

2. Define convection heat transfer. Explain the types of convection with an example.

Part B

(2 Q x 4 M = 08 Marks)

3. In Finland on 20th February 2018, it was found that the inside wall temperature of a certain building was found to be 22°C. That building wall is made up of 6.0 in of concrete, 2.0 in of fiberglass insulation, and 38 in of gypsum board. The outside wall temperature was found to be -12°C. Calculate the R value and the heat loss per unit area.

4. A triangular fin of stainless steel (18% Cr, 8% Ni) is attached to a plane wall maintained at 460°C. The fin thickness is 6.4 mm, and the length is 2.5 cm. The environment is at 93°C, and the convection heat-transfer coefficient is 28 W/m^2.°C. Calculate the heat lost from the fin.

Part C

(1 Q x 6 M = 06 Marks)

5. A 1.0-mm-diameter wire is maintained at a temperature of 400°C and exposed to a convection environment at 40°C with h=120 W/m^2.°C. Calculate the thermal conductivity that will just cause an insulation thickness of 0.2 mm to produce a “critical radius.” How much of this insulation must be added to reduce the heat transfer by 75 percent from that which would be experienced by the bare wire?