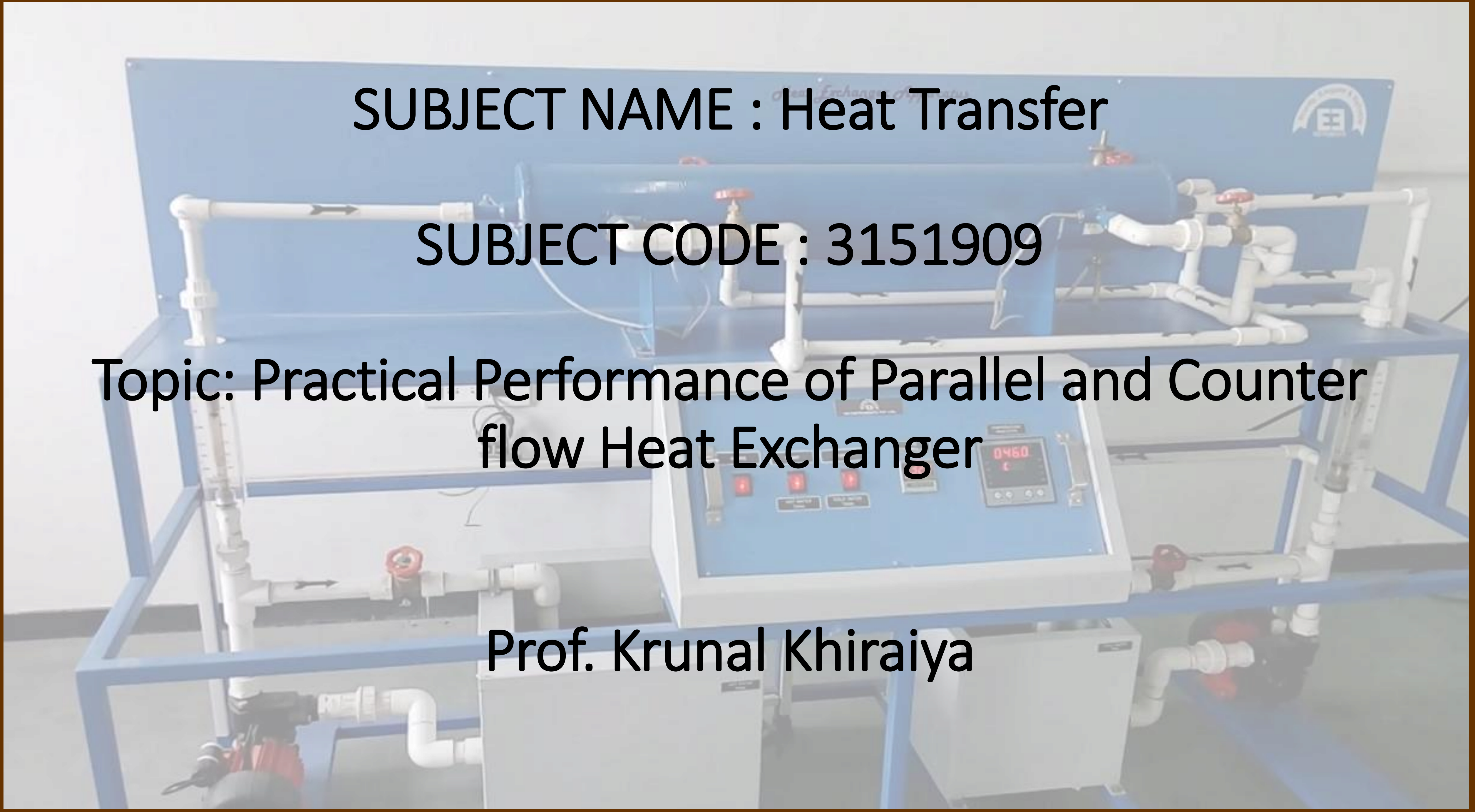


SUBJECT NAME : Heat Transfer

SUBJECT CODE : 3151909

Topic: Practical Performance of Parallel and Counter flow Heat Exchanger

Prof. Krunal Khiraiya

Aim

- To compare overall heat transfer coefficient for Parallel and Counter flow in a Double Pipe Heat Exchanger.

- To compare practical value overall heat transfer coefficient with the theoretical value.

Procedure

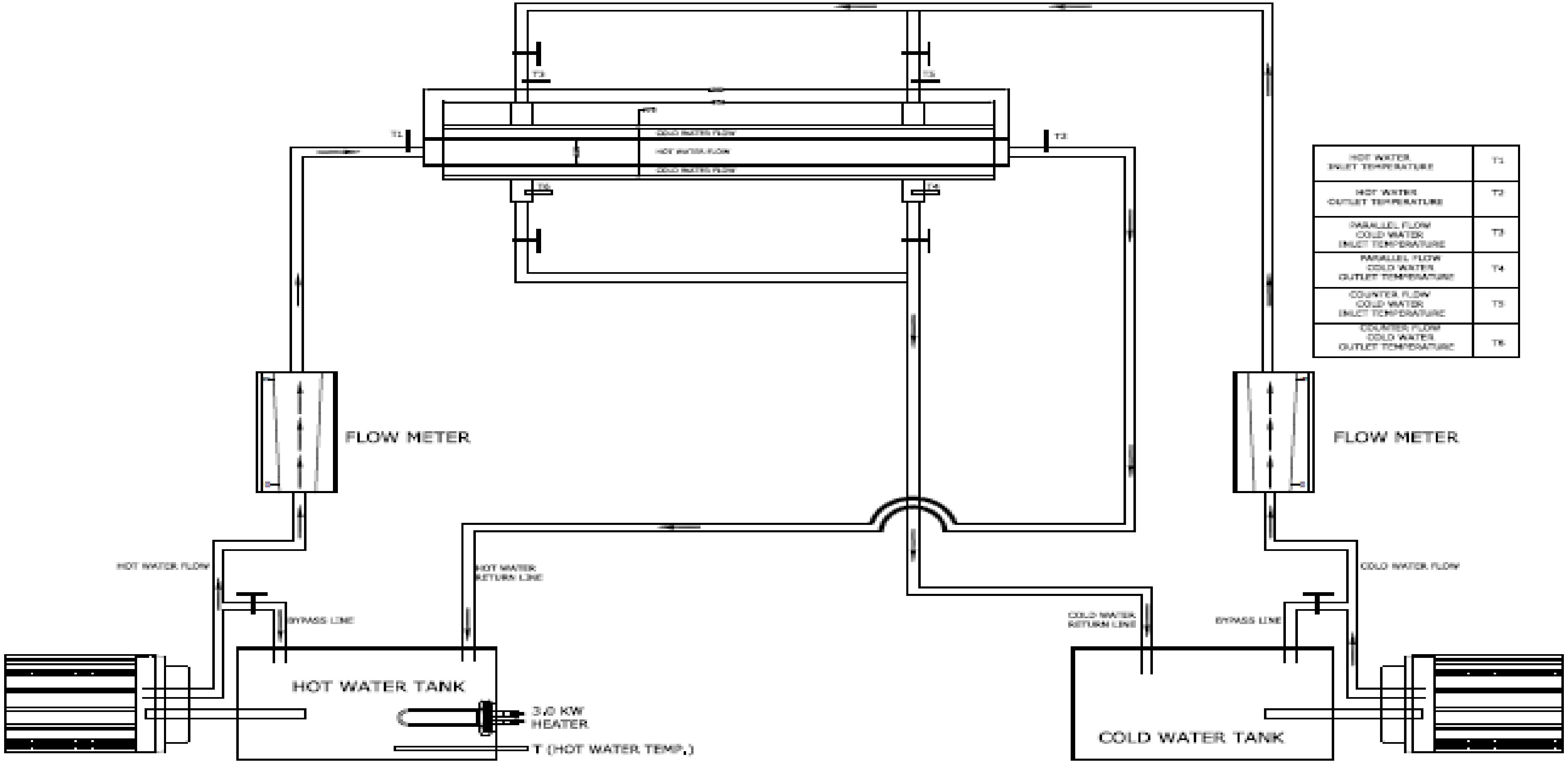
1. Fill the hot water tank with about 40 liter of clean tap water.
2. Switch on the immersion type heater (3 kW) provided in the hot water tank and heat the water to the desired temperature (about 60-70 °C). Intermittently switch ON the pump with bypass line valve fully open and supply valve fully closed to ensure through mixing of water in the tank to ensure uniform temperature.
3. After achieving the desired temperature of water in the hot water tank, switch ON the pump (0.5 HP) and allow the hot water to flow through shell side and adjust the flow rate to the desired value using the valve for about five minutes. Recycle the exit of the hot water to the hot water tank.

Procedure

4. Operate the alternate valves out of four valves provided on the control panel in such a manner so that the heat exchanger operate in co-current flow mode.
5. Start the cold water supply on the shell side and adjust the flow rate to the desired value. Now place the outlet of both shell and tube side in to the drain line.
6. Monitor the hot water inlet temperature and maintain it at the constant value by switching the heater either on/ off with the help of thermostat provided on the control panel of the tank.

Procedure

7. Observe the inlet and outlet temperature of both cold and hot water streams and note down them after they achieve steady state.
8. Also note down the flow rates of hot water and cold water with the help of rota meters.
9. Repeat the above procedure either by changing the flow rates or by changing the inlet temperature of the hot water.
10. Alter the heat exchanger from co-current flow mode to counter-current flow mode and repeat the experiment.



HOT WATER INLET TEMPERATURE	T1
HOT WATER OUTLET TEMPERATURE	T2
PARALLEL FLOW COLD WATER INLET TEMPERATURE	T3
PARALLEL FLOW COLD WATER OUTLET TEMPERATURE	T4
COUNTER FLOW COLD WATER INLET TEMPERATURE	T5
COUNTER FLOW COLD WATER OUTLET TEMPERATURE	T6

	DATE	NAME
DRG		
DRN	20.11.15	NIKUL
CHD		
TRG.		
COMP.		
SCALE	----	
MATL	----	

COMPANY: EIE INSTRUMENTS PVT.LTD

FIRM

TITLE: PARALLEL AND COUNTER FLOW EXCHANGER APPARATUS

PROJECTION

APPROVED

DRG NO.

Observation Table

Hot Water Side			Cold Water Side		
Flow Rate m_h (lpm)	T_1 (°C)	T_2 (°C)	Flow Rate m_c (lpm)	T_3 (°C)	T_4 (°C)

Observation taken for parallel flow

Cold Water (Outer Pipe)			Hot water (Inner Pipe)		
Flow rate (lpm)	**Inlet Temp. (^oC)**	**OutletTemp. (^oC)**	**Flow rate (lpm)**	**InletTemp. (^oC)**	**OutletTemp. (^oC)**
m_C	$T_3 = T_{CI}$	$T_4 = T_{CO}$	m_H	$T_1 = T_{HI}$	$T_2 = T_{HO}$
2.5	38.2	41.9	2.5	51.8	48.3
2.5	**48.7**	**53.7**	**2.5**	**65.5**	**61.6**

Sample Calculation

- Flow rate of hot water in kg/ s

  $m_H = m_h * \rho / 60$

  $= (2.5 * 1) / 60$

  $= 0.0425$ kg/ s

  (1lpm=0.017kg/sec)

- Heat Transferred by the Hot Water to the Cold Water

  $Q_H = m_H \, x C_{pH} \, x \, (T_1 – T_2)$

  $= 0.042 \times 4186 \times (65.5-61.6)$

  $= 685.6$ watts

- Where, C_{pH} of water = 4.18 kj/kgk = 4186 j/kgk
- Flow rate of cold water in kg/ s

  $m_C = mc * \rho / 60$

  $= (2.5 * 1) / 60$

  $= 0.042$ kg/ s

- Average Heat Transferred

  $Q = (Q_H + Q_C) / 2 = (685.6+879.06)/2 = 782.33$watts

- Area for the Heat Transfer,

  $A = \Pi * d_o * L = 3.14 * 0.025 * 0.950 \; m^2 = 0.07457 \; m^2$

- where,

d_o = Outer Diameter of Inner Pipe,=0.025 m

L = Effective Total Length of Heat Exchanger=0.950 m

- True Temperature Difference

$$\Delta T_{lm} = \frac{(T_3 - T_4) - (T_1 - T_2)}{\ln \frac{(T_3 - T_4)}{(T_1 - T_2)}}$$

- LMTD= 11.8 ^{0}C
- Overall Heat transfer coefficient can be calculated using,

  Practical $U_0 = Q / (A \times LMTD) = 782.3/(0.07457 \times 11.8)$

  $= 889.0 \; w/m^2 \, {}^\circ c$

THANK YOU