

OR

- b. The three types of material containing wall made up of. The distance between wall is 0.114m, 0.229m, respectively. Temperatures are 760°C and 76.6°C. Thermal conductivity $K_1 = 0.138 \text{ W/m}^\circ\text{C}$, $K_2 = 1.38 \text{ W/m}^\circ\text{C}$. Find the interface temperature. (06)

- Q-4 a. Discuss the construction and working of shell & tube heat exchanger with neat diagram. (06)
- b. Oil (70kg/min) flowing through the tube side is cooled from 50°C to 34°C using water (36kg/min) entering at 15°C shell side. 20 tubes are kept in shell (ID 0.8m), each tube has ID 0.027m and OD 0.03, $k_m = 0.02 \text{ kJ/min.m}^\circ\text{C}$.

Mass	ρ (kg/m ³)	Cp (KJ/kg.°C)	K (KJ/min.m.°C)	μ (kg/m.min)
Oil	910	2.0	0.012	2.52
Water	1000	4.18	0.036	0.06

Calculate the U_0 and require length of heat exchanger for:

Parallel flow heat exchanger (06)

OR

- b. **Counter flow heat exchanger** (06)

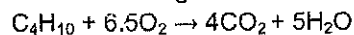
- Q-5 a. 100Kg of feed to a distillation column contains 28% benzene & 72% toluene. The distillate contains 52% benzene & residue contains 5% benzene. Calculate the Kg of distillate and residue and % recovery of benzene. (06)
- b. 100Kg mixture of acetone (28%) and chloroform (72%) by weight is to be separated by extraction using a solvent. Calculate the weight ratio of feed to solvent. The composition of extract and raffinate is as follows: (06)

	Acetone	Chloroform
Extract	7.50	3.50
Raffinate	20.30	67.30

OR

- b. Calculate the pressure required for small oxygen cylinder having 0.015m³ volume and each containing 0.5kg of O₂. Cylinder is subjected to a maximum temperature of 323K. $R = 8.314 \text{ m}^3.\text{kPa/kmole.K}$ (06)

- Q-6 a. A combustion reactor is fed with 50kmole butane and 2100kmole air. Calculate the % excess air for following reaction. (06)



- b. Groundnut seed contains oil and solids 45% each are fed to an expeller. The cake contains 80% solids and 5% oil. Calculate the %recovery of oil. (06)

OR

- b. A stream of CO₂ flowing at rate of 100Kmol/hr is heated from 298K to 383K. Calculate heat that must be transferred per second. $n=100$, $(a=21.3655, b= 64.28 \times 10^{-3}T, c= - 41.05 \times 10^{-6}T^2, d= 9.79 \times 10^{-9}T^3)$ in KJ/KmolK. (06)

