Applied Thermofluids-2 (ME40603/ME40701)

1st Class Test (1st August 2017)

Max. Marks: **20**   Duration: **60 minutes**

$\longleftrightarrow$
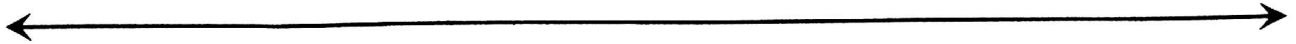
Make suitable assumptions, wherever necessary

1. A power plant based on simple Rankine cycle operates between a heat source temperature of **500°C** and a heat sink temperature of **40°C**. If the thermal efficiency of this cycle is **60 %** of the ideal cycle operating between the same temperatures, what is the rate at which this power plant generates entropy (in kW/K) per **MW** of net power generation?   **(4)**

2. In a power plant, **240 kg/s** of steam from turbine enters the closed feedwater heater at **35 bar** and **300°C (h= 2976 kJ/kg, s=6.444 kJ/kg.K)** and leaves as condensed water at **40°C (h= 1087 kJ/kg, s=2.796 kJ/kg.K)**. Liquid feedwater at a temperature of **40°C** enters the feedwater heater with a flow rate of **530 kg/s** and leaves the feedwater heater as liquid at **240°C**. Taking an average c_p value of liquid water as **4.2 kJ/kg.K**, find the lost work in the feedwater heater if the surroundings are at **35°C**.   **(8)**

3. Feedwater from a power plant condenser is pumped in a feedwater pump from a condenser pressure of **0. 1 bar** and a temperature of **40°C** to a boiler pressure of **165 bar**. If the flow rate of the feedwater is **530 kg/s**, find a) the power input to the feed water pump, b) temperature and entropy of water at the exit of the pump. Take: density of water = **992 kg/m³**, c_p value of liquid water = **4.2 kJ/kg.K** and entropy of saturated liquid water = **0 kJ/kg.K**. The efficiency of the feedwater pump = **90%.**   **(6)**

4. Draw the T-s diagram of a **Rankine cycle** with **single reheat** and **single open feedwater regeneration**. The **reheat and regeneration** take place **at the same pressure** and the state of steam at the inlet to the reheater and feedwater heater is **saturated vapour**.   **(2)**