QUIZ 2A – APPLIED THERMODYNAMICS

NAME: ……..

ID. NO.: …….....

Q1. Sketch *T-s* diagram for Rankine cycle with clear label for the following condition:

- Condensate pressure = 100 kPa
- Boiler pressure = 3 MPa
- Inlet temperature to the turbine = 350°C

Determine thermal efficiency of the cycle.

(7 mark)

ANSWER

Q2. Consider a steam power plant that operates on a reheat Rankine cycle and has a net power output of 100 MW. Steam enters the high-pressure turbine at 9 MPa and 550°C and the low-pressure turbine at 1 MPa and 550°C. Steam leaves the condenser as a saturated liquid at a pressure of 10 kPa. The isentropic efficiency of the turbine is 80 percent, and that of the pump is 95 percent. Show the cycle on a *T-s* diagram with respect to saturation lines, and determine

(a) the quality (or temperature, if superheated) of the steam at the turbine exit,
(b) the thermal efficiency of the cycle, and
(c) the mass flow rate of the steam.The amount of heat transferred to the air during the heat addition process

(18 marks)

ANSWER

QUIZ 2B – APPLIED THERMODYNAMICS

NAME: ……..

ID. NO.: …….....

Q1. Basically, there are three methods in how to increase thermal efficiency of the Rankine cycle; i) Lowering the condensate pressure, ii) Superheating the steam to the higher temperature, and iii) Increase the boiler pressure. Apply one of the methods to increase thermal efficiency of the following cycle at least 3 percent.

- Condensate pressure = 100 kPa
- Boiler pressure = 3 MPa
- Inlet temperature to the turbine = 350°C

(7 mark)

ANSWER

Q2. A steam power plant operates on the reheat Rankine cycle. Steam enters the high-pressure turbine at 12.5 MPa and 600°C at a rate of 8 kg/s and leaves at 1.6 MPa. Steam is then reheated at constant pressure to 500°C before it expands in the low-pressure turbine. The isentropic efficiencies of the turbine and the pump are 90 percent, respectively. Steam leaves the condenser as a saturated liquid. If the moisture content of the steam at the exit of the turbine is not to exceed 5 percent, determine

(a) the condenser pressure,
(b) the net power output, and
(c) the thermal efficiency

(18 marks)