MURANG'A COLLEGED OF TECHNOLOGY
SUPPLEMENTARY EXAMINATIONS
ME/A/P/11D
MECHANICAL TECHNOLOGY
TIME: 3 HOURS
DATE: 7TH SEPTEMBER 2012

INSTRUCTIONS TO CANDIDATES.

- Attempt **FOUR** Questions as Instructed.
- All Questions carry equal marks.

SECTION A: THERMODYNAMICS

ANSWER **BOTH** QUESTIONS IN THIS SECTION.

QUESTION ONE.

(a) By use of a diagram, describe the working principles of the ORSAT apparatus
    used in the analysis of combustion. (5 marks)

(b) A quantity of a fuel has the following analysis C-82%, H-6%, 0-6% and N- 7%.
    He dry flue gas analysis showed 14% CO_2 and some oxygen, determine

      (i)   Stoidoiometric air fuel ratio.
      (ii)   Mixture strength.
      (iii)   Percentage of excess air supplied. (15 marks)

QUESTIONS

(a) Develop an expression, for the logarithmic mean temperature difference for
    a parallel flow heat exchanger in terms of the inlet and outlet. Temperatures
    of the fluid i.e

$$\Theta_M \frac{(\Theta_2 - \Theta_1)}{\ln\left(\dfrac{\Theta_2}{\Theta_1}\right)}$$

(11 marks)

(b) A furnace wall consists of 125mm wide refractory brick and 125mm wide
    insulating firebrick separated by an air gap. The outside wall is covered with
    a 12mm thickness of plaster. The heat transfer coefficient form the outside
    wall surface to the air in the room is $17W/m^2K$ and the resistance to heat flow
    of the air gap is 0.16K/W, the thermal conductivity of the refractory
    brick, insulating firebrick and the plaster are 1.6, 0.3 and 0.14 W/mK
    respectively. Considering $1m^2$ of surface area, Determine

      (i)   The rate of heat transfer
      (ii)   The interface temperature and the temperature of the outside surface
           of the wall . (9 marks)