NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF TECHNICAL TEACHER EDUCATION

COURSE: Thermodynamics **COURSE CODE: 0147**

PART: 0 - BRIDGING **YEAR: 2011**

1st SEMESTER EXAMINATIONS January 2011

Duration : 3 hours

Answer 5 questions

QU 1.

i). Define the term thermodynamics [2]

(ii). State and explain the four laws of thermodynamics [12]

(iii).Explain briefly the origins and development of thermodynamics as a field of study [6]

Qu 2.

An air receiver of volume $6m^3$ contains air at 15bar and 40.5^OC. A valve is opened and some air is allowed to blow out to atmosphere. The pressure of the air in the receiver drops rapidly to 12bar when the valve is then closed. Calculate the mass of air which has left the receiver. Take R=0.287KJ/kgK

[20]

Qu3.

1kg of a perfect gas is compressed from 1.1bar, $27^{O}C$ according to a law $pv^{1.3}$ until the pressure is 6.6bar. Calculate the heat flow to or from the cylinder walls when the gas is ethane (molar mass 30kg/kmol) which has c_p =2.10kJ/kgK [20]

Qu4

air flows steadily at the rate of 0.4kg/s through an air compressor, entering at 6m/s with a pressure of 1bar and a specific volume of $0.85m^3$/kg and leaving at 4.5m/s with a pressure of 6.9bar and specific volume of $0.16m^3$/kg. The specific internal energy of air leaving is 88kJ/kg greater than that of air entering. The cooling water in the jacket surrounding the cylinder absorbs heat from the air at the rate of 59kW. Calculate:

i). the power required to drive the compressor [10]

ii). the inlet and outlet pipe cross-sectional area [10]

Qu 5

i). In the compression stroke of an internal combustion engine the heat rejected to the cooling water is 45kJkg and the work input is 90kJ/kg. Calculate the change in specific internal energy of the working fluid stating whether it is loss or a gain. [10]

ii).explain the term reversibility, what are its applications [10]

qu 6

0.25kg of air at apressure of $140KN/m^2$ occupies $0.15m^3$ and from this condition it is compressed to$1.4MN/m^2$ according to the law $PV^{1.25}$=C. Determine:

i) The change in internal energy of the air [8]

ii). The work done on or by the air [6]

iii). Heat received or rejected by the air [6]

Take c_p =1.005kJ/kgK, C_V =0.718KJ/KgK.

QU7

A quantity of gas occupies $0.4m^3$ at a pressure of $100kN/m^2$ and temperature of 20^OC. The gas is compressed isothermally to a pressure of $450kN/m^2$ and then expanded adiabatically to its initial volume. Determine;

i). the heat transferred during compression [8]

ii). the change in internal energy during expansion [6]

iii).the mass of the gas [6]

gamma =1.4 Cp =1.0kJ/kgK

END OF EXAMINATION