MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)

University Examinations for 2015/2016

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

SECOND SEMESTER EXAMINATION FOR DIPLOMA IN MECHANICAL ENGINEERING

SUPPLEMENTARY EXAMINATION

MED-PR 212: THERMODYNAMICS II

DATE: 2/8/2016 **TIME: 2.00-4.00 PM**

INSTRUCTIONS:

Answer Question One and any Other Two Questions

SECTION A

1. a) With the aid of a heat engine diagram, explain the second law of thermodynamics. (3 marks)

   b) A rigid cylinder of volume 0.025 m^2 contains steam at 80 bar and350^0c. The cylinder is cooled until the pressure is 50bar. Calculate the state of the steam after cooling and the amount of heat rejected by the steam. Sketch the process on a t-s diagram indicating the area that represents the heat flow. (10 marks)

   c) In a gas turbine unit air is drawn in at 1.02 bar and 15^0c, and is compressed to 6.12 bar. Calculate the thermal efficiency and the wirk ratio of the ideal constant pressure cycle, when the maximum cycle temperature is limited to 800^0c. (10 marks)

   d) i) Outline three major types of ic engines (3 marks)

   ii) Differentiate between the following as used in fuels and combustion.

   a. Proximate analysis and ultimate analysis (2 marks)

b. Rich mixture and weak mixture (2 marks)

SECTION B

2. Steam at 100 bar,375^0c expands isentropically in a cylinder beind a piston to a pressure of 10bar. Calculate the work done per kg of steam. Represent the process on a t-s giagram. (20 marks)
3. An oil engine takes in air at 1.01 bar,20^0c and the maximum cycle pressure is 69 bar. The compression ratio is 18/1. Calculate the air standard thermal efficiency based on a dual combustion cycle. Assume that the heat added at constant volume is equal to the heat added at constant pressure. (20 marks)
4. A gas engine is supplied with coal gas of the following composition: 53.6% h_2; 9% co; 25% ch_4; 3% c_4h_8; 0.4% o_2; 3% co_2; 6% n_2. If the air fuel ratio is 6.5/1 by volume, calculate the analysis of the dry products of combustion. It can be assumed that the stoichiometric a/f ratio is less than 6.5/1. (20 marks)
5. Air at 15^0c and 1.05 bar occupies 0.02 m^3. The air is heated at constant volume until the pressure is 4.2 bar, and then cooled at constant pressure back to the original temperature. Calculate the net heat flow to or from the air and the net entropy change. Sketch the process on a t-s diagram. (20 marks)