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KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF
B.SC (RENEWABLE ENERGY AND BIOFUELS TECHNOLOGY)

COURSE CODE: PRD 371

COURSE TITLE: THERMODYNAMICS II

DURATION: 2 HOURS

DATE: 10TH JANUARY 2018 TIME: 9 – 11 AM

INSTRUCTIONS TO CANDIDATES

- (i) Answer Question 1 (Compulsory) and any other TWO questions
- (ii) All symbols have their usual meaning
- (iii) Use steam tables provided

This paper consists of 3 printed pages. Please Turn Over



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QUESTION ONE (COMPULSORY) – 30 MARKS

a) What is the function of an air compressor? **(1 Mark)**

b) Use a P-V diagram to explain the processes in a Diesel cycle **(5 Marks)**

c) With the help of a suitable sketch, explain two limitations of using a Carnot cycle to analyse a steam plant, and recommend the most suitable cycle

(5 Marks)

d) What do you understand by the following terms?

(i) Back pressure turbines **(2 Marks)**

(ii) Pressure compounding in turbines **(2 Marks)**

e) Give three implications of the Second Law of Thermodynamics **(5 Marks)**

f) Use a T-S diagram to explain the processes in an Otto cycle **(5 Marks)**

g) Use a P-V diagram to explain the processes in a Joule-Brayton cycle **(5 Marks)**

QUESTION TWO – 20 MARKS

Dry saturated steam at a pressure of 9.5MPa is expanded isothermally to a pressure of 0.8MPa.

a) Calculate the heat supplied during the process **(10 Marks)**

b) Calculate the work done during the process **(7 Marks)**

c) Show the process on a T-S diagram **(3 Marks)**

QUESTION THREE – 20 MARKS

An oil engine based on a dual combustion cycle operates with an inlet pressure and temperature of 1.01bar and 20⁰C respectively, a maximum pressure of 69bar, and a compression ratio of 18. The heat supplied during the constant volume process is the same as the heat supplied during the constant pressure process.

- a) Sketch the p-v diagram for the engine (2 Marks)
- b) Calculate the air standard thermal efficiency (11 Marks)
- c) Determine the mean effective pressure (7 Marks)

QUESTION FOUR – 20 MARKS

A steam power plant operates between a boiler pressure of 42bar and a condenser pressure of 0.035bar. The steam entering the turbine is initially superheated at 500⁰C. When the steam is expanded in the turbine to a pressure of 2.3bar, it is reheated to 500⁰C and thereafter allowed to expand to a pressure of 0.035bar.

Neglecting feed-pump work, calculate the:

- a) Cycle efficiency (15 Marks)
- b) Work ratio (2 Marks)
- c) Specific steam consumption (3 Marks)

QUESTION FIVE – 20 MARKS

Methane undergoes an Atkinson cycle. The gas is compressed adiabatically from 2.1 bar at 27⁰C to 8.4 bar. The maximum pressure of the cycle is 15.7 bar.

Calculate the thermal efficiency of the cycle.

(20 Marks)