TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN MARINE ENGINEERING

EMR 2313 : APPLIED THERMODYNAMICS II (PP1)

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: Pick Date Select Month Pick Year

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt any THREE questions.

Do not write on the question paper.

Question ONE

a) Explain any FOUR criteria used to classify and identify Internal Combustion engines giving an example for each criteria. (8 marks)

b) A 4 stroke carbureted engine runs at 2 500 rev/min. The engine capacity is 3 liters. The air is supplied at 0.52 bar and 15^{o}C with an efficiency ratio of 0.4. The air fuel ratio is 12/1. The calorific value is 46 MJ/kg. Calculate the heat released by combustion.

(12 marks)

Question TWO

a) Using sketches explain the FOUR strokes of a spark ignition engine piston. (12 marks)

b) A four stroke carbureted engine runs at 2500 rpm. The engine capacity is 3000cc. Air is supplied at 0.52 bar and 15◦C with an efficiency ratio of 0.4. The air fuel ratio is 12/1 and the calorific value of fuel is 46 MJ/Kg. calculate the heat released by combustion. (8 marks)

Question THREE

a) Using sketches explain the working principles of the following compressors;
   i. Sliding vane
   ii. Straight lobe

(9 marks)

b) A single stage reciprocating compressor operates polytropically according to the law $PV^n = C$. It sucks in 1 m^3 of air at 1.013 bars and 15◦C and compresses it to 7 bars. If the efficiency is 83% and n=1.35 calculate the indicated power of the compressor.

(11 marks)

Question FOUR

a) Using explain the operational principals of a propeller (turbo-prop) engine gas turbine. (8 marks)

b) A gas turbine uses the Joule cycle. The pressure ratio is 6/1. The inlet temperature to the compressor is 10◦C. The flow rate of air is 0.2 kg/s. The temperature at inlet to the turbine is 950◦C. Calculate the following.

   i. The cycle efficiency.
   ii. The heat transfer into the heater.
   iii. The net power output.
   Take $\Upsilon = 1.4$, Cp = 1.005 kJ/kg K (12 marks)

Question FIVE

a) Using a flow chart diagram explain how electricity is produced by a fossil fueled steam turbine plant (7 marks)

b) A steam turbine with a pressure ratio of 6:1 intakes 15 kg of steam per second at 15◦C with a maximum cycle temperature of 600◦. The efficiencies of the compressor and turbine are 82% and 85% respectively. The compression process has a Cp of 1.005KJ/KgK and Υ of 1.4, while the expansion process has a Cp of 1.11KJ/KgK and Υ of 1.332. Calculate the power output of the turbine.

(13 marks)