# 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.**

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**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 $\Upsilon$ of 1.4, while the expansion process has a Cp of 1.11KJ/KgK and $\Upsilon$ of 1.332. Calculate the power output of the turbine.

(13 marks)