



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA YEAR I SEMESTER II

EPL 2101 : MECHANICAL PLANT THEORY

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: Pick Date May 2016

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.

Assume: 1 bar = 10^5 N/m², 1 atm = 101.3 kN/m², 1 hp = 0.7457kW

Question ONE

- Define the term fuel. (2 marks)
- Differentiate between “proximate analysis” and “ultimate analysis” and state their relevance. (4 marks)
- List **THREE** types of fuel. (3 marks)
- Determine the percentage excess air supplied to boiler for burning the coal having the following composition on mass basis. C=0.82, H₂=0.05, O₂=0.08, N₂=0.03, S=0.005 and moisture = 0.018. Volumetric analysis of dry flue gases shows the following composition: CO₂=10%, CO=1%, N₂=82% and O₂=7%. (11 marks)

Question TWO

- Define the term “Compressor” (2 marks)
- State and explain **THREE** classification of compressors. (3 marks)
- Describe the working of a single stage reciprocating compressors. (4 marks)

- d. A single stage, single acting reciprocating air compressor has air entering at 1bar, 20°C and compression occurs following polytropic process with index of 1.2 up to the delivery pressure of 12bar. The compressor runs at the speed of 1240rpm and has L/D ratio of 1.8. The compressor has mechanical efficiency of 0.88. Calculate the:
- isothermal efficiency
 - cylinder dimensions
 - rating of drive required to run the compressor which admits 1m^3 of air per minute (11 marks)

Question THREE

- Define the term “Internal Combustion Engine”. (2 marks)
- Briefly explain the operation of a four stroke diesel engine. (8 marks)
- State TWO advantages of 2-stroke engines. (2 marks)
- State FOUR differences between diesel engine and petrol engine. (4 marks)
- Explain the difference between Otto Cycle and Diesel Cycle in I.C. engines. (4 marks)

Question FOUR

- Differentiate between pumps and compressors. (4 marks)
- State FOUR ways of increasing pressure of fluids by pumps. (4 marks)
- List FOUR losses in rotodynamic pumps. (4 marks)
- Differentiate between reciprocating pumps and rotary pumps. (4 marks)
- List FOUR characteristics of positive displacement pumps. (4 marks)

Question FIVE

- Define the following terms with reference to fuels and combustion. (4 marks)
 - Air-fuel ratio
 - Volumetric analysis
- Describe THREE types of fuels giving relevant examples. (6 marks)
- A hydro-carbon fuel when burned with air gave the following Orsat analysis; $\text{CO}_2=11.94\%$, $\text{O}_2=2.26\%$, $\text{CO}=0.41\%$ and $\text{N}_2=83.39\%$. Calculate:- (10 marks)
 - Air- fuel ratio
 - The percent carbon and hydrogen in the fuel on mass basis
 - Percentage theoretical air supplied. Assume air to have 21% oxygen.