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/$m^{2,}$ 1 atm = 101.3 kN/m^2, 1 hp = 0.7457kW

Question ONE

a. Define the term fuel. (2 marks)

b. Differentiate between "proximate analysis" and "ultimate analysis" and state their relevance. (4 marks)

c. List THREE types of fuel. (3 marks)

d. Determine the percentage excess air supplied to boiler for burning the coal having the following composition on mass basis. C=0.82, H_2=0.05, O_2=0.08, N_2=0.03, S=0.005 and moisture = 0.018. Volumetric analysis of dry flue gases shows the following composition: CO_2=10%, CO=1%, N_2=82% and O_2=7%. (11 marks)

Question TWO

a. Define the term "Compressor" (2 marks)

b. State and explain THREE classification of compressors. (3 marks)

c. 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^{o}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 l240rpm and has L/D ratio of 1.8. The compressor has mechanical efficiency of 0.88. Calculate the:
   i. isothermal efficiency
   ii. cylinder dimensions
   iii. rating of drive required to run the compressor which admits 1m^3 of air per minute (11 marks)

Question THREE

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

Question FOUR

a. Differentiate between pumps and compressors. (4 marks)
b. State FOUR ways of increasing pressure of fluids by pumps. (4 marks)
c. List FOUR loses in rotodynamic pumps. (4 marks)
d. Differentiate between reciprocating pumps and rotary pumps. (4 marks)
e. List FOUR characteristics of positive displacement pumps. (4 marks)

Question FIVE

a. Define the following terms with reference to fuels and combustion. (4 marks)
   i. Air-fuel ratio
   ii. Volumetric analysis
b. Describe THREE types of fuels giving relevant examples. (6 marks)
c. A hydro-carbon fuel when burned with air gave the following Orsat analysis; CO_2=11.94%, O_2=2.26%, CO=0.41% and N_2=83.39%. Calculate:- (10 marks)
   i. Air- fuel ratio
   ii. The percent carbon and hydrogen in the fuel on mass basis
   iii. Percentage theoretical air supplied. Assume air to have 21% oxygen.