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 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.

Question TWO

a. State FOUR different arrangements that can be used to maintain the isothermic efficiency close to 100%.   (4 marks)

b. Discuss THREE applications of compressed air. (3 marks)
c. Explain the effects of clearance upon the performance of reciprocating compressors. (3 marks)
d. A reciprocating compressor of single stage and double acting type is running at 1200rpm with mechanical efficiency of 85%. Air flows into compressor at rate of 5m^3/min measured at atmospheric condition of 1.02 bar, 27°C. Compressor has compressed air leaving at 8 bar with compression following polytropic process with index of 1.3. Compressor has clearance volume of 5% of stroke volume. During suction of air from atmosphere into compressor, its temperature rises by 10°C. There occurs a loss of 0.05bar during discharge passage through valves. Calculate the; (10 marks)
    i. dimensions of cylinder
    ii. volumetric efficiency
    iii. power input required to drive the compressor if stroke to bore is 1.5

Question THREE

a. Briefly explain the process of production of power by I.C. engine. (5 marks)
b. State by giving examples, THREE types of I.C. engines. (6 marks)
c. State THREE essential functions of a fuel injection system. (3 marks)
d. Briefly explain the engine shutting down procedure. (6 marks)

Question FOUR

a. Define the term rotodynamic pumps. (2 marks)
b. State TWO ways of managing stuffing losses. (2 marks)
c. Explain FOUR characteristics of positive displacement pumps. (8 marks)
d. Explain FOUR loses in rotodynamic pumps. (8 marks)

Question FIVE

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)