



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

- 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; CO₂=11.94%, O₂=2.26%, CO=0.41% and N₂=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 $5\text{m}^3/\text{min}$ 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 losses 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)