

EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION
(MINISTRY OF HIGHER EDUCATION)

MECHANICAL ENGINEERING DEPARTMENT

FINAL EXAMINATION
DECEMBER 2011 SESSION

J4100 : ENGINEERING PLANT TECHNOLOGY

DATE : 24 APRIL 2012 (TUESDAY)
DURATION : 2 HOURS (8.30 AM - 10.30 AM)

This paper consists of **FIVE (5)** pages including the front page.
Structured/Essay (6 questions – answer any **4 question**)

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THE CHIEF INVIGILATOR

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J4100: Engineering Plant Technology

QUESTION 1

- (a) State the function of a boiler. (2 marks)
- (b) Every boiler is equipped with safety devices to ensure catastrophic failures can be avoided. One of those devices is a fusible plug :-
- i. state the definition of fusible plug. (2 marks)
 - ii. explain how fusible plug works in order to avoid catastrophic damages to boilers. (6 marks)
- (c) State **THREE (3)** reasons why water treatment must be done in boiler operation. (3 marks)
- (d) There are **SIX (6)** main components in a steam power plant. State a function for each main component. (12 marks)

QUESTION 2

- (a) State **TWO (2)** types of steam turbine. (2 marks)
- (b) State **THREE (3)** ways of controlling steam turbine speed. (3 marks)
- (c) Explain the necessity of high vacuum in the steam turbine operation. (8 marks)
- (d) Explain with the aid of an appropriate diagram the working principle of gravity force type fly ball governing with the aid of an appropriate diagram (12 marks)

QUESTION 3

- a) State **FOUR (4)** differences between reciprocating compressor and rotary compressor. (6 marks)
- b) List **FOUR (4)** advantages of multistage compression. (6 marks)
- c) Sketch and explain the working of an air compressor which are suitable to deliver a low flow rate and high pressure compressed air. (13 marks)

QUESTION 4

- (a) Sketch how turbo jet engine (aircraft engine) functions. (5 marks)
- (b) Give **THREE (3)** methods to improve the efficiency of gas turbine. (6 marks)
- (c) A gas turbine power plant operates as in Figure 1. Draw a diagram of Temperature (T) versus Entropy (S) for the operation of the gas turbine cycle.

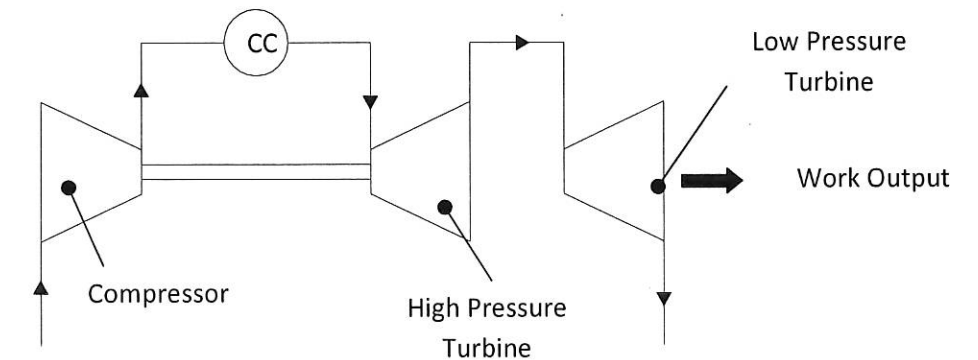


Figure 1

- (d) Based on the Question 4(c) if the low-pressure turbines operating at a temperature of 470.6°C and the output temperature is 346°C , find the thermal efficiency if the heat supplied was 472.1 kJ/kg .
Given $C_{pg} = 1.15 \text{ kJ/kg K}$ (6 marks)

QUESTION 5

- (a) Positive displacement pump can be divided into two groups which is reciprocating pump and rotary pump:-
- i. name **THREE (3)** types of rotary pump. (3 marks)
 - ii. one of the popular reciprocating pumps is plunger pump. Draw the plunger pump and explain how the plunger pump works. (12 marks)
- (b) State the differences between hydrostatic pump and hydrodynamic pump. (10 marks)

QUESTION 6

- (a) State **TWO (2)** advantages and disadvantages of two-stroke engine. (4 marks)
- (b) What are the **TWO (2)** major differences between diesel engine and petrol engine? (3 marks)
- (c) State the function of the component in an internal combustion engine system given below:- (6 marks)
- i. cylinder head
 - ii. crank shaft
 - iii. connecting rod
- (d) In two-stroke petrol engine, suction, compression, power and exhaust operations are completed in one revolution of the crank shaft. Sketch and explain the operation of all strokes. (12 marks)