JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

UNIVERSITY EXAMINATIONS FOR THE DEGREE IN SCIENCE IN RENEWABLE ENERGY TECHNOLOGY AND MANAGMENT

THIRD YEAR RESIT EXAMINATIONS 2020/21 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TET 3314

COURSE TITLE: Steam Plant Energy Technology

EXAM VENUE: **STREAM: BSc REN TECH & MGT**

DATE: ../11/2020 EXAM **SESSION:**

DURATION: 2 HOURS

Instructions

1. **Answer question 1 (Compulsory) and ANY other two questions**
2. **Candidates are advised not to write on question paper**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

QUESTION ONE (COMPULSORY)

a) What do you understand by the following terminologies [2 Marks]

i. Power cycles

ii. Isentropic process

b) With an aid of a neatly sketched diagram showing the fundamental components, discuss the basic operation of a steam power plant. [10 marks]

c) Name and describe five main types of vapour power cycles that are commonly used in steam power generation. [10 Marks]

d) In a steam power cycle, the steam supply is at 42 bar and dry and saturated. The condenser pressure is 0.035 bar. Calculate the cycle efficiency, the work ratio and the specific steam consumption if the plant operates under a Rankine cycle with dry saturated steam at entry to the turbine. [12 marks]

QUESTION TWO

a) Explain the working of Rankine cycle in steam power plant with suitable T-s and flow diagrams. [14 Marks]

b) Discuss the characteristics of ideal working fluid for vapours power cycles. [6 marks]

QUESTION THREE

a) Outline five (5) advantages and five (5) disadvantages of steam power plants. [10 marks]

b) Show that the overall efficiency of a two-fluid coupled cycles is equal to the sum of individual efficiency of the two cycles minus their product. [5 Marks]

c) Discuss the advantages of the combined cycle power generation. [5 marks]

QUESTION FOUR

a) Due to the environmental concern on the contribution of thermal power plants to pollution of the environment, you have been asked to advice the power generating company on how to minimise the discharge of toxic substances. What would you advice the power company to do? [8 Marks]

b) With the aid of sketches describe the principle of operation of the following methods in flue gas cleaning.

i. Settling Chambers

ii. Fabric Filters

iii. Mechanical Scrubbers

iv. Electrostatic precipitators [12 Marks]

QUESTION FIVE

a) Briefly discuss superheaters and their classifications [4 marks]

b) What are the advantages of using superheated steam in a rankine power cycle? [2 Marks]

c) A steam turbine plant operates on Rankine cycle with steam entering turbine at 40 bar, 350ºC and leaving at 0.05 bar. Steam leaving turbine condenses to saturated liquid inside condenser. Feed pump pumps saturated liquid into boiler. Determine the net work per kg of steam and the cycle efficiency assuming all processes to be ideal. Also show cycle on T-s diagram. Also determine pump work per kg of steam considering linear variation of specific volume.[14 Marks]