



THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING - 3rd YEAR DEGREE

SECOND SEMESTER EXAMINATIONS - 2023

CE 325- ENERGY & ENVIRONMENTAL ENGINEERING

DATE: WEDNESDAY, 25th OCTOBER 2023 – 1:00 P.M.

VENUE: HLT

TIME ALLOWED: 3 HOURS

INFORMATION FOR CANDIDATES

1. Write your NAME and Student NUMBER clearly on the front page. Do it now.
2. You have 10 minutes to read the paper before the examination starts. You must not begin writing during this time.
3. There are THREE sections (A, B, C) in this paper. Answer all questions to gain 100 marks.
4. Only a Calculator is allowed in the examination room. Mobile phones are not allowed (Switch your mobile phones off). Notes and textbooks are not allowed.
5. Use only a Black or Blue ink to write your answers on the ANSWER SHEET provided.
6. Do not use pencils for writing except for drawings and sketches.
7. Start each question on a new page and show all your calculations in the answer book provided. No other material will be accepted.
8. Marking Scheme: Marks are indicated for each of the questions.

SECTION A: SHORT ANSWER QUESTIONS

(50 Marks)

1. Describe the key steps involved in conducting a life cycle assessment (LCA) of a building's environmental impact. **(5 Marks)**
2. Briefly explain the key energy conversions that take place in buildings. **(3 Marks)**
3. Describe three advantages and two disadvantages of district heating system **(3 Marks)**
4. Briefly discuss two supply-side flexibility measures and two demand-side flexibility measures in energy systems. **(3 Marks)**
5. List three ways in which energy use in buildings can be optimized to improve efficiency and reduce environmental impacts. **(3 Marks)**
6. What is the correct chemical equation for burning fossil fuels? **(3 Marks)**
7. Name three building elements that can be simulated. **(3 Marks)**
8. Name three types of energy resources. **(3 Marks)**
9. What are 5 disadvantages of Energy Flexibility? **(5 Marks)**
10. What are the major environmental impacts associated with the use of fossil fuels for electricity generation? **(5 Marks)**
11. What are the different allocation methods used in life cycle assessment to assign and compare environmental loads between co-products? **(3 Marks)**
12. What is embodied energy and why is it important to consider its function in building design? **(3 Marks)**
13. What are the advantages and disadvantages of using hydro energy system **(3 Marks)**
14. Brief how thermal energy is sourced and explain how it can benefit Papua New Guinea. **(5 Marks)**

SECTION B: DEFINE COMMON ENERGY & ENVIRONMENTAL TERMS (10 Marks)

1. What is allocation in the building energy context? (1 Marks)
2. Define combustion. (1 Marks)
3. What are renewable energy sources? (1Marks)
4. Define greenhouse gases. (1 Marks)
5. What is energy efficiency? (1 Marks)
6. What are district heating pipes? (1 Marks)
7. What is cogeneration? (1 Marks)
8. Define load shifting. (1 Marks)
9. What is biomass? (1 Marks)
10. Define climate control. (1 Marks)

SECTION C: SHORT ANSWERS AND CALCULATION

SHORT ANSWERS

(10 Marks)

1. Green plants use carbon dioxide for photosynthesis and return oxygen to the atmosphere, even then carbon dioxide is considered to be responsible for the greenhouse effect. Explain why? **(5 Marks)**
2. Explain how does greenhouse effect affect global warming? **(5 Marks)**

SHORT ANSWERS

(30 Marks)

1. A 100 kg block of iron initially at 25°C is heated to 150°C. Calculate the amount of heat transferred to the iron block. Given: Specific Heat Capacity of Iron = 0.45 J/g°C **(5 Marks)**
2. A company emits 500 kg of methane (CH₄) with a GWP of 25. Calculate the CO₂ emissions of the company. **(5 Marks)**
3. A wind turbine has a cumulative energy input of 1,000,000 kWh and an annual energy output of 200,000 kWh. Calculate the energy payback time for the wind turbine. **(5 Marks)**
4. A river flows with a volume of 10,000 cubic meters in 24 hours. Calculate the water flow rate in liters per second. **(5 Marks)**
5. A power plant emits 1000 metric tons of CO₂ and consumes 5000 MWh of energy. Calculate the carbon intensity of the power plant. **(5 Marks)**
6. A battery stores 5000 Joules of energy in a volume of 0.1 cubic meters. Calculate the energy density of the battery. **(5 Marks)**

.....**END OF EXAM**.....