



TECHNICAL UNIVERSITY OF MOMBASA

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Faculty of Engineering and Technology  
Department of Mechanical & Automotive Engineering  
UNIVERSITY EXAMINATION FOR:  
BSc. / B. Eng. Mechanical Engineering  
EMG 2521 : ENERGY MANAGEMENT  
SPECIAL/SUPPLEMENTARY EXAMINATION  
SERIES: SEPTEMBER 2018  
TIME: 2 HOURS  
DATE: Pick Date Sep 2018

**Instruction to Candidates:**

You should have the following for this examination

- *Answer booklet*
- *Non-Programmable scientific calculator*

This paper consists of **FIVE** questions. Attempt any other **THREE** questions.  
Maximum marks for each part of a question are as shown.

**Do not write on the question paper.**

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**Question ONE**

- Explain the following terms as used in the financial analysis of Tariffs and indicate the expected range for each as used in assessing the financial performance of a utility company
  - Interest coverage ratio
  - Gearing
  - Current ratio (6 marks)
- The audit report should conclude with specific recommendations for detailed engineering studies and feasibility analyses. Give **FIVE** recommendations after carrying out a detailed energy audit from a cement manufacturing company A ( 5marks)
- The overall goal of Kenya's energy sector is to provide affordable, sustainable and reliable source of energy. Give **FOUR** strategic objectives to enable the achievement of this goal ( 4marks)

## Question TWO

- a) Utilities usually charge their customers an additional fee when their power factor is less than 0.95. In fact some utilities are not obligated to deliver electricity to their customer when the P.f falls below 0.85. Explain the causes of low P.f and give THREE benefits of improving the P.f (3 marks)
- b) In a power plant the steam from the boiler reaches the turbine at a temperature of 9000C. The spent steam leaves the turbine at a temperature of 1000C. Calculate the maximum efficiency of the turbine ( 4marks)
- c) Define the term Energy Audit and explain the need for firms to carry out Energy Audits ( 4marks)
- d) Discuss the energy sources and demand patterns in the various sectors of Kenya's economy (6marks)
- e) Define the term tariff and with the aid of an equation, give the general tariff format (3marks)

## Question THREE

- a) Define the term load shedding and explain THREE techniques used in load shedding (4 marks)
- b) A beverage company A has a transformer of 1200 apparent power. Given that the P.f is 0.65 and the actual power produced is 900KW. calculate
  - i. The reactive power
  - ii. The actual power when the P.f is improved to 0.9 with the same apparent power. ( 4 marks)
- c) With the aid of an equation explain the following types of tariff structures and the type of consumer best suited for each tariff
  - i. Hopkinson demand Rate
  - ii. Doherty Rate
  - iii. Wright demand Rate (6 marks)
- d) Explain the steps used in the methodology of carrying out a detailed energy Audit report under the following phased
  - i. Pre-audit phase
  - ii. Audit phase
  - iii. Post Audit phase ( 6marks)

#### Question FOUR

- a) Using a sketch explain the term load factor hence calculate the load factor when the peak demand is 8.25KW and the average demand is 3.0 KW (3 marks)
- b) Explain the methods of improving P.f and name **THREE** power factor improvement companies in Kenya (4 marks)
- c) Explain **THREE** factors to be considered during procurement of fuels for energy efficiency and economics (5marks)
- d) Define the term plant energy performance and discuss any **THREE** key instruments used in the measuring of plant energy performance (5marks)
- e) Explain the major developments or events for Kenya in the nuclear power sector (3marks)

#### Question FIVE

- a) Explain the policy objectives of retail tariffs and give **FOUR** desirable characteristics of a tariff structure ( 6 marks)
- b) Define the term efficiency s used in energy conversion and explain **THREE** common energy conversion efficiency challenges ( 6marks)
- c) Calculate the efficiency of performance of a refrigerator that consumes 900 watts of power to remove heat at a rate of 7BTU per second (4marks)
- d) Explain the following types of energy Audit techniques  
Preliminary Audit  
Detailed Audit (4marks)