



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FIFTH YEAR FIRST SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE IN
ELECTRICAL AND ELECTRONICS ENGINEERING

EEE 507: ENERGY MANAGEMENT AND ENVIRONMENTAL PROTECTION

DATE: 31/7/2017

TIME: 11:00 – 1:00 PM

INSTRUCTIONS

- *This paper consists of Five Questions*
- *Question One is Compulsory*
- *Attempt Any other Two Questions*

QUESTION ONE (COMPULSORY) (30 MARKS)

- Define Energy Management (1 mark)
- State the Two Objectives of Energy Management. (2 marks)
- Explain using a diagram, the overall scheme of the IMPACT 2002+ framework linking the inputs, the midpoints and the endpoint indicators of an Energy System Environmental Effects. (5 marks)
- Discuss in detail the *Midpoint Indicators* for each of the following *End Points*
 - Optimal emissions reduction
 - Human health
 - Ecosystem
 - Resources cost (6 marks)
- Using the model in 1c) above and the midpoints in 1d), derive and explain the formulation of an Environmental Decision Making Tool (EDMT) considering the utilization of Renewable(Wind and Solar) and a thermal base. (13 marks)
- Explain the Tradeoff between the Midpoint and the End Point Approaches of EDMT (3 marks)

QUESTION TWO (20MARKS)

- a) Explain the Six Green House Gases (GHG) (3 marks)
- b) Explain Four Ozone Depleting Products. (2 marks)
- c) State any Four Power plant products responsible for global acidification potential. (2 marks)
- d) Explain any Seven socio-political factors influencing policy on Renewable Energy Systems. (7 marks)
- e) Explain the Six policy tools aimed at conserving the environment in power generation (6 marks)

QUESTION THREE (20MARKS)

- a) Explain the following terms as used in Life Cycle Analysis (LCA) of Energy Systems
 - (i) Life Cycle Inventory Analysis (LCIA)
 - (ii) Life Cycle Impact Assessment (LCIA) (2 marks)
- b) Explain the benefits and limitations of conducting Life Cycle Assessment (LCA) of an Energy System. (5 marks)
- c) Explain Four Factors limiting the application of Life Cycle Assessment (LCA) results (4 marks)
- d) Explain the life cycle phases of a power generating plant, hence using a diagram, discuss the life cycle scope of such a plant. (9 marks)

QUESTION FOUR (20MARKS)

“Renewable Energy is Clean” Using five specific renewable sources as examples and the necessary relationships, explain why this traditional claim must be moderated. (20 marks)

QUESTION FIVE (20MARKS)

- a) State the Two Types of Energy Audit (2 marks)
- b) State the Various Parameters that must be measured in an Energy Audit Exercise (4 marks)
- c) Explain the use of the following Instruments in Energy Management Audit
 - (i) Infrared Thermometer
 - (ii) Fyrite
 - (iii) Fuel Efficiency Monitor
 - (iv) Combustion analyzer

- (v) Contact thermometer
 - (vi) Water flow meter
 - (vii) Tachometer
 - (viii) Leak Detectors
 - (ix) Lux meters
 - (x) Pitot Tube and manometer (5 marks)
- d) Discuss the Five attributes of a successful energy policy. (5 marks)
- e) Explain Four Challenges facing Energy Audit in Kenya. (4 marks)