



UNIVERSITY OF RUHUNA

Faculty of Engineering

End - Semester 7 Examination in Engineering: August 2015

Module Number: ME 7363

Module Name: Energy Technology

[Three Hours]

[Answer all questions, each question carries ten marks]

NOTE: Provide sketches and diagrams where appropriate

Q1. "It is estimated that about 5% of the households in Sri Lanka will eventually have to be supplied through Off - Grid Electrical Power Systems. Pilot studies have been conducted to identify viable Off - Grid Power Generation options for Rural Communities using biomass based power generation technologies. However, the expected performance from such systems have not been achieved"

a) Identify and discuss a small - scale biomass based power generation technology applicable for Off - Grid Electricity Generation in rural areas.

[3 Marks]

b) State three major factors that you would consider when assessing the feasibility for an Off - Grid biomass based power generation project.

[2 Marks]

c) Discuss how the factors identified in Q1.b) above, will contribute towards the success or failure of the project.

[3 Marks]

d) Provide a brief description of Biomass Integrated Gasifier/ Gas Turbine (BIG/GT) Technology.

[2 Marks]

Q2. a) List out two main applications of solar energy used in the world.

[2 Marks]

b) Define the term "Photovoltaic". With aid of a neatly drawn sketch explain the working of a solar cell.

[2 Marks]

c) List out five types of solar collectors and explain their operation by providing suitable sketches.

[5 Marks]

d) What are the advantages of solar energy over fossil fuel?

[1 Mark]

- Q3. a) Give a brief account of historical development of wind power usage, especially relating it to transportation and engineering. [2 Marks]
- b) Sketch a horizontal-axis wind turbine and label the most important parts in its interior. [2 Marks]
- c) The power coefficient of wind rotor (C_p) is defined as the ratio between energy extracted from the wind and the energy available in the undisturbed wind. Show that the maximum theoretical value the C_p can achieve is 0.593. [2 Marks]
- d) How does Sri Lanka use wind energy at present? Where are the major installations located in the country? [2 Marks]
- e) What are the government's plans for the future of wind energy in Sri Lanka? [2 Marks]
- Q4. a) Ocean is a vast source of energy. What are the obstacles for harnessing energy from oceans? [2 Marks]
- b) Comment on ocean energy potential for Sri Lanka. You may state geographical locations to help your answer. [2 Marks]
- c) State the types of wave energy extraction devices giving sketches, and briefly describe how each of them works. [2 Marks]
- d) OTEC technologies can extract thermal energy from oceans. Describe the principle of operation of OTEC plants with aid of sketches. [2 Marks]
- e) Apart from power generation, what other uses can be obtained from OTEC plant? [2 Marks]
- Q5. a) State major classes of hydroelectric power turbines. [2 Marks]
- b) Sketch a hydroelectric power scheme, showing all the important components starting from reservoir to the generator. [2 Marks]
- c) What are the parameters that would determine the maximum power output from a hydroelectric plant? [2 Marks]
- d) State major differences between impounded systems and run-off-the river systems. [2 Marks]
- e) Geothermal reservoirs contain hot fluids. Suggest a scheme where you can use these hot fluids to cool the houses. You may provide a sketch. [2 Marks]