



Module Number: ME 7312

Module Name: Energy Technology

[Three Hours]

[Answer all questions, each question carries ten marks]

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*NOTE: All assumptions must be stated clearly. Sketches and diagrams are to be provided where required. Symbols stated herein denote standard parameters.*

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 Question Q1b) above, will contribute towards the success or failure of the project.

[3 Marks]

d) With neatly drawn sketches, provide a brief description of Biomass Integrated Gasifier/ Gas Turbine (BIG/GT) Technology.

[2 Marks]

Q2. a) State the definition of biogas? What would be the normal composition of biogas?

[2 Marks]

b) What are the triple important benefits you can obtain from Biogas Technology?

[1.5 Marks]

c) By drawing a schematic diagram, briefly explain three stages of anaerobic fermentation of biomass.

[1.5 Marks]

d) Name five (05) factors that influence the biogas production.

[2.5 Marks]

e) Based on the construction, what are the three main types of simple biogas plants available in the world? With an appropriate sketch briefly explain the function of any biogas plant stated above.

[2.5 Marks]

Q3. a) List out three main applications of solar energy used in the world.

[2 Marks]

b) Describe solar thermal cooling with relevant data.

[2 Marks]

- c) By using suitable technical terms describe the solar diagram shown in Figure Q1 (c) in point form. (Angles, assumed region, diagram's characteristics, etc.) [4 Marks]
- d) Discuss the advantages and disadvantages of solar energy over fossil fuel. [2 Marks]

- Q4. a) Point out the five (05) main methods of ocean energy extraction. [1 Mark]
- b) "Ocean is considered as the world largest thermal collector and also there are obstacles for harnessing energy from ocean". Give reasons in point form to verify statement. [2 Marks]
- c) State the types of wave energy extraction devices with sketches and briefly describe them. [2 Marks]
- d) Describe the OTEC Technology with relevant technical data (with advantages, disadvantages, suitable sketches, etc.). [3 Marks]
- e) Tidal range of tide at a particular oceanic place is 10 m and the surface of the harnessing Tidal Barrage plant is 10 km<sup>2</sup>. Assuming the power conversion efficiency to be 36%, Calculate the daily and yearly average power generation of the plant in MW.
- Take low tide the potential energy is zero and assume,
- 706 tidal cycles per year, (12h 24min per cycle)
  - $g = 9.81 \text{ m/s}^2$  - gravitational constant
  - $r = 1025 \text{ kg/m}^3$  - density of seawater
- [2 Marks]

- Q5. a) Most of Hydro power plants are consisted with "Dams". Describe the different kind of dams with suitable sketches. [2 Marks]
- b) Categorize different kind of turbines with respect to Type of Turbine and Head Classification. [2 Marks]
- c) What are the major individual characteristics of turbines listed in Question Q5b)? [2 Marks]
- d) "A hydropower project is identified as Low Impact if it considers several Environmental Factors". What are the factors to be considered before implementation of a hydro power plant in a particular place? [1 Mark]
- e) One of major renewable energy sources is "Wind Energy". Describe the Wind Energy Extraction with suitable technical data and sketches. (Your answer should include methods, turbine types, parts, turbine operating phenomena, power equation, general efficiency, etc.). [3 Marks]

(c) Univ. of Oregon SRML  
Sponsor: BPA  
Lat: 52; Long: 4.5  
( Solar ) time zone: 1  
Rotterdam

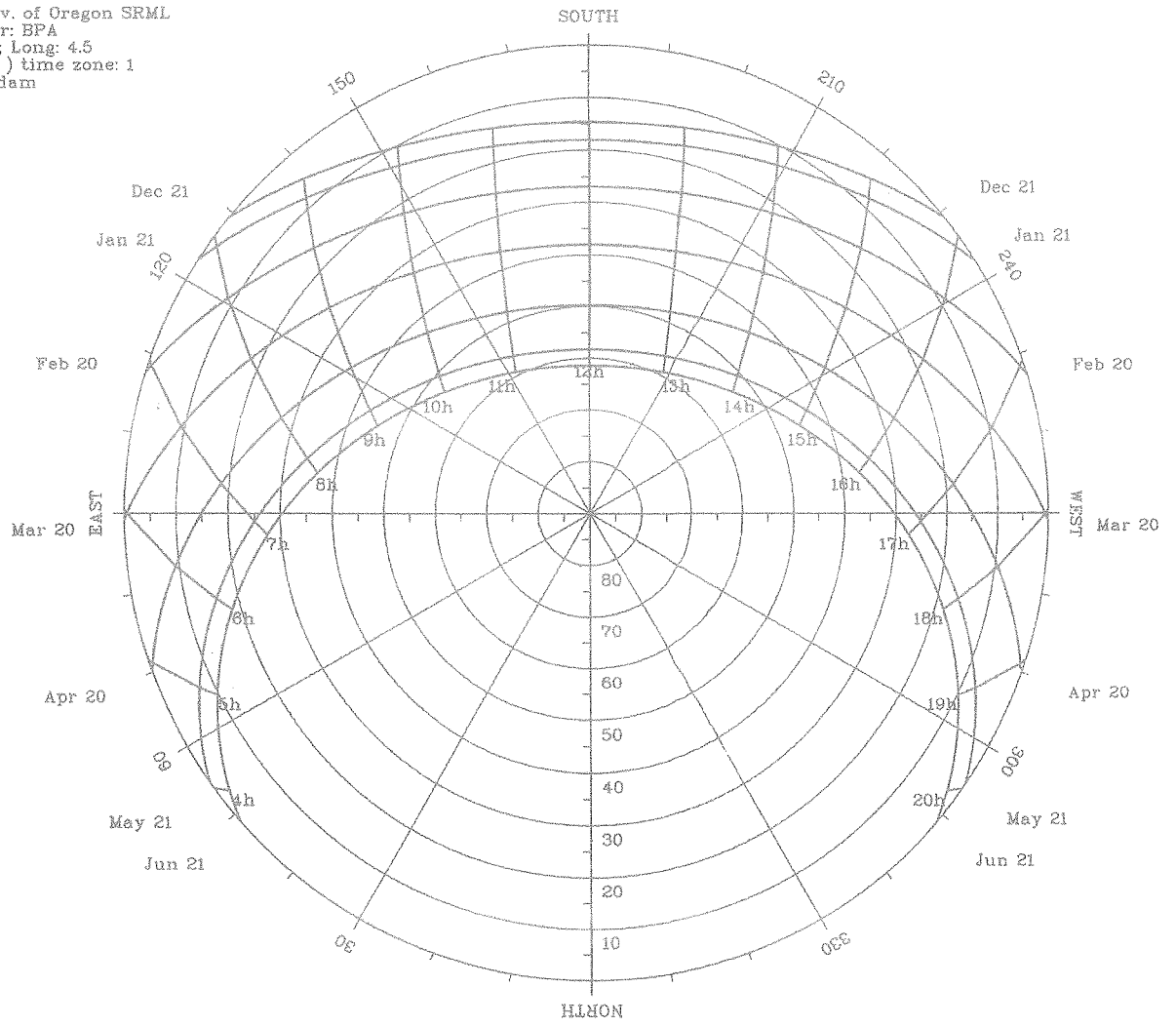


Figure Q1 (c)