

University of Ruhuna- Faculty of Technology
Bachelor of Engineering Technology
Level 2 (Semester 1) Examination, October 2018

Course Unit: ENT 2132 - Renewable and Alternative Energy Technology

Time Allowed: 2 hours

Answer all Four (04) questions. Calculators are allowed to use for calculations.
[All symbols have their usual meaning]

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- 01 1.1 Explain two main types of energy sources useful for power generation.
- 1.2 Briefly explain how hydroelectric power generation works.
- 1.3 List two advantages and disadvantages of hydroelectric power generation.
- 1.4 Explain three available hydroelectric (Hydel) schemes in world.
- 1.5 Identify three principal components available in Hydel schemes and briefly explain them.
- 1.6 The dam is 400 m high, the head (distance the water falls) is 400 m. The typical flow rate is 62.50 cms. The turbine and generator are 75% efficient. Calculate how much power can be generated by the power plant.

[25 Marks]

- 02 2.1 Explain the biomass base power generation cycle in direct combustion/steam turbine system.
- 2.2 Assume that wood fuel consists of 78% volatile and 22% fixed carbon (dry basis). The calorific value of fuel wood and carbon are taken as 18.5 MJ/kg and 32 MJ/kg, respectively.
Calculate the contribution to the calorific content from fixed carbon and volatile constituents separately.
- 2.3 The properties of Bambo i.e. the composition in terms of cellulose, hemicelluloses and lignin and the heating values of those constituents given as follows.

Composition		Heating values (MJ/kg)
Cellulose	48.04%,	17
Semi-cellulose	26.00%	17
Lignin	25.00%	25
Ash	0.96%	

- I. Calculate HHV_D Bambo.
- II. If the moisture content on wet basis is given by m , then calculate LHV of Bambo. Take the hydrogen content of dry wood is 6.4% and $m = 50\%$.
Hints: $HHV = (1-m) \times HHV_D$
 $LHV = (1-m) \times HHV_D - 2.447 \times [m + (1-m) \times 0.064 \times 9]$
- III. Calculate LHV of Bambo when $m = 26\%$ and $m = 6\%$.

[25 Marks]

- 03
- 3.1 Identify the two forms of Ocean energy.
 - 3.2 Oscillating Water Column (OWC) is an ocean energy conversion system that has proven successful at the Shoreline, Near the Shoreline and Off-shore. Explain the principle of OWC.
 - 3.3 Explain the principle of Tidal power and difference between Spring Tides and Neap Tides.
 - 3.4 Explain the operation principle of Tidal Barrage.
 - 3.5 Write-down the pros and cons of the Tidal Barrage and Tidal current and explain which technology is best to harvest the Sri Lankan Ocean energy.

[25 Marks]

- 04
- 4.1 Explain the Logarithmic Law in wind energy.
 - 4.2 Company A planned to install its wind energy plant in forest area. Calculate the wind speed when the tower height is 70 m long. Note that ground roughness (Z_0) is 0.7 m, Karman constant is 0.4 and shear velocity is 0.695 ms^{-1} .
 - 4.3 Explain *Cut-in Speed*, *Rated Speed* and *Cut-out Speed* of Wind turbine.
 - 4.4 Briefly explain three different components of solar radiation incident on a surface at earth.
 - 4.5 Briefly explain the working principle of Linear Fresnel Reflector.

[25 Marks]

Heating value (MJ/kg)	Composition
17	Cellulose
17	Semi-cellulose
25	Lignin
	Ash