

ERGU Tutorial Week No: 9 – Renewable Energy

Q.1

Define the term ‘Renewable’ Energy and briefly discuss its advantages and disadvantages with regards to current energy sources.

Q. 2

Experiments on a flat-plate solar collector reveal that

$$F(\tau\alpha) = 0.8188$$

And

$$FU = 7.0041$$

Given this information and assuming that the collector is located in air at 12°C and that it receives 400W/m² of solar radiation, determine the efficiency and output of the collector when:

- (i) Delivering water at a mean temperature of 35°C
- (ii) Delivering water at a mean temperature of 45°C

Q. 3

a) Briefly describe the three main photoelectric processes;

- (i) Photemissivity
- (ii) Photoconductivity
- (iii) Photovoltaic effect

b) A photovoltaic module produces 1000W/m² at a mean temperature of 25°C. The performance i.e. operating power of the module drops by 0.5% for every 1°C increase in temperature. Calculate the operating power of a module of area 8000mm x 6000mm at temperatures :

- (i) 30°C
- (ii) 35°C
- (iii) 40°C

Q. 4

A wind turbine with three rotor blades, each in length of 4m, exhibits a C_p of 0.39 when the TSR is 3. Assuming that η_g is 0.85 and η_e is 0.9, and the density of air is 1.201kg/m³, calculate

- (i) The electrical power produced by a turbine operating in 15m/s winds
- (ii) The speed of the rotor blades at this wind velocity.

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Q. 5

Name the two types of wind turbine categories used and list two advantages and disadvantages for each. List also a typical application for each.

The answer can be given in a table form.

Q. 6.

- a) The surface of a reservoir is 400m above a turbine, which is required to produce 300MW of electricity. If the overall efficiency of the penstock, turbine and generator is 83%, what is the volume flow rate of water required by the turbines?
- b) There are three main types of turbine design. Name them.

Q. 7

What is the power associated with an ideal deep-sea wave of height 1.75m and wavelength 300m? (Assume $g = 9.81\text{m/s}^2$)

Q. 8

Define the term 'Biomass' and briefly discuss its use as a 'renewable' energy source.

End of Tutorial – Week No: 9