

M.E. DEGREE EXAMINATIONS: NOV/DEC 2010

Third Semester

ENERGY ENGINEERING

EEG 557: Thermal Energy Storage Systems

Time: Three Hours

Maximum Marks: 100

Answer ALL Questions:-

PART A (10 x 2 = 20 Marks)

1. What are the energy storage devices in thermal power plants?
2. Define Seasonal thermal energy storage.
3. What is the use of TRNSYS?
4. Differentiate between simple bed and rock bed thermal storage systems.
5. Define regenerators.
6. What are the step changes in gas flow rate?
7. Difference between conduction and convection dominated phase change.
8. What are the storage materials modeling of phase change problems.
9. Mention some power plant applications.
10. What is meant by global warming?

PART B (5 x 16 = 80 Marks)

11. a) List out the energy storage devices. Explain any two of them.

(OR)

- b) Explain in detail about seasonal thermal energy storage.

12. a) What is simple bed and rock bed thermal energy storage systems? Explain.

(OR)

- b) Explain in detail about pressurized water storage systems for power plant applications.

13. a) Design a regenerator, the following data is given:

Available heating surface area $A = 31.40\text{m}^2$:

Corresponding heat storing mass $M_m = 4898.4 \text{ kg}$:

Specific heat of packing $C_m = 0.92 \text{ kJ/kg C}$:

Specific heat of gas (both periods) $C_f = 1.011 \text{ kJ/kg C}$:

Gas mass flow channel (hot period) $m_{f'} = 0.156 \text{ kg/s}$:

Gas mass flow channel (cold period) $m_{f''} = 0.078 \text{ kg/s}$:

Heat transfer coefficient (hot period) $\hat{h}' = 50.23 \text{ W/ m}^2\text{C} :$

Heat transfer coefficient (cold period) $\hat{h}' = 25.11 \text{ W/ m}^2\text{C} :$

Length of hot period $P' = 3600\text{s} :$

Length of cold period $P' = 10800\text{s} :$

Determine the following:

- (i) Reduced length and Reduced period for both hot and cold
- (ii) Harmonic mean parameters
- (iii) Ratio of reduced period and reduced length
- (iv) Effectiveness of hot and cold periods

(OR)

b) Derive the expression for latitudinal conduction in the regeneration checker work.

14. a) What is Temperature and enthalpy model? Explain in detail.

(OR)

b) Explain in detail about conduction dominated phase change model.

15. a) Write short notes on food preservation and green house heating.

(OR)

b) Discuss some of the power plant applications of thermal energy storage system.
