M.E DEGREE EXAMINATIONS: JAN 2015

(Regulation 2014)

First Semester

ENERGY ENGINEERING

P14EETE17**:** Energy Conversion Systems

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. An ideal Brayton cycle, operating between the pressure limits of 1 bar and 6 bar, $[K_1]$ has minimum and maximum temperatures of 300K and 1500K. The ratio of specific heats of the working fluid is 1.4. The approximate final temperatures in Kelvin at the end of the compression and expansion processes are respectively

   a) 500 and 900   b) 900 and 500

   c) 500 and 500   d) 900 and 900

2. Match the following thermodynamic cycle with respect to the engines $[K_1]$

        1) Carnot   i) Semi diesel engine

        2) Otto   ii) Hypothetical engine

        3) Diesel   iii) Steam engine

        4) Dual   iv) Petrol engine

        5) Rankine   v) Constant pressure heat addition engine

   a) 1-ii, 2-iv, 3-v, 4-i, 5-iii   b) 1-ii, 2-iii, 3-iv, 4-v, 5-i

   c) 1-ii, 2-v, 3-iv, 4-iii, 5-i   d) 1-ii, 2-v, 3-i, 4-iv, 5-iii

3. A computer IC chip can be cooled by $[K_1]$

   a) TE system   b) Compressor based technology

   c) Blowing air   d) Solar energy

4. Thermoelectric heating system can also be used to behave like a refrigerator $[K_1]$ when the polarity of applied voltage is

a) Reversed

b) Lowered

c) Amplified

d) Zero

5. When the distance between the sun and flat solar panel is doubled the power [K₁] delivered by the solar cell is

a) Decreased by 4 times

b) Increased by 4 times

c) No change

d) Increased by 2 times

6. Ascertain (A): The quality of energy gets degraded as temperature decreases [K₁] Reason (R): Degradation is caused by entropy

a) Both A and B are true and R is the correct explanation of A

b) Both A and B are individually false but R is not the correct explanation of A

c) A is true but R is false

d) A is false but R is true

7. The pure forms of energy storage [K₁]

a) Chemical and electrical

b) Thermal and electrical

c) Chemical and nuclear

d) Nuclear and thermal

8. Sequence the processes of dual engine [K₁]

   i) suction ii) compression iii) constant volume heat addition iv) constant pressure heat addition v) expansion vi) exhaust

a) i-ii-iii-iv-v-vi

b) ii-i-iv-iii-vi-v

c) vi-v-iv-iii-ii-i

d) iii-ii-i-vi-v-iv

9. Fuel cells are not limited by thermodynamic limitation of heat engine such as [K₁] the efficiency of

a) Carnot

b) Diesel

c) Otto

d) Stirling

10. The equipment that gives high efficiency of power generation [K₁]

a) Solar cell

b) Fuel cell

c) Batterie

d) Power Plant

PART B (10 x 2 = 20 Marks)

11. For the same temperature limits which cycle has maximum efficiency among Carnot and Otto cycles. And explain the same. [K$_2$]

12. Define availability in terms irreversibility. [K$_1$]

13. Define elastic strain energy storage system. [K$_1$]

14. Give the types of electrical energy storage system. [K$_2$]

15. List out the uses of the lead acid and Ni iron batteries. [K$_1$]

16. Describe the function of internal resistance in generator. [K$_2$]

17. State Seeback effect. [K$_2$]

18. List out the types of secondary cells. [K$_1$]

19. Define fuel cell stacking. [K$_1$]

20. State the types of fuel cells. [K$_2$]

PART C (10 x 5 = 50 Marks)

21. A Diesel engine has a compression ratio of 14 and cut-off takes place at 6% of the stroke. Calculate the air standard efficiency. [K$_4$]

22. Make en elaborative note on comparison of performance of Otto, Diesel and Dual cycles for the same compression ratio. [K$_4$]

23. State the effect and explain the working principle of thermo-electric refrigerator with its advantages and disadvantages. [K$_2$]

24. List out and explain the types of thermionic converters and also explain the merits of thermionic converters over thermoelectric converters. [K$_2$]

25. Explain the electrical energy storage system and its types. [K$_2$]

26. List out the necessities of different types of energy storage systems. [K$_1$]

27. Derive the expression for solar cell performance [K$_2$]

28. Explain Ni-Cd and Lead Acid batteries in detail. [K$_2$]

29. Explain about phosphoric acid fuel cell with its advantages and disadvantages. [K$_2$]

30. Describe fuel cells performance variables in detail. [K$_2$]

PART D (2 x 10 = 20 Marks)

31. Steam at 20 bar, 360°C is expanded in a steam turbine to 0.08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Assuming ideal processes, calculate per kg of steam the net work and the cycle efficiency. [K$_4$]

32. State the principle of mechanical energy storage system and explain any one of mechanical energy storage systems with a neat sketch. [K$_2$]

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