Final exam questions

Subject group name: **Energy conversion**

Neptun code: ZVEGEENNWEC

Credit points: 5

Subject in this subject group:

- **Energy conversion** (BMEGEENNWEC)

Program: Mechanical Engineering Modelling MSc (2N-MW0-2019)

Specialization(s): Thermal engineering

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You can check the current subject forms at the Educational Portal of the Faculty of Mechanical Engineering.

https://oktatas.gpk.bme.hu/

Always check the for updates at edu.gpk.bme.hu before preparing for the exam, especially if the subject group contains at least one subject from your final semester!

Valid from 01 September 2021

Dr. Edit CSÉFALVAY

associate professor

I. Basics
1. Describe the Joule-Brayton Cycle: chart, p-V and T-S diagram!
2. What are differences in between Carnot and Standard- vapour compression cycles? Show process flow in T-S chart!
3. Give a scheme of refrigeration, chart T-S and log p-h diagram!

II. Cooling
1. Explain the standard vapour compression cycle (T-S and logp-h diagrams)? Explain the planning process of vapour compression system for given (t_c , t_a) external conditions?
2. What are the effects of evaporation and condensation temperatures on C.O.P. (Coefficient of Performance)
3. What does the sub-cooling mean in refrigerating system? What are the effects of that on C.O.P.? Show the process flow in T-S chart.
4. Explain the Multi-stage (compound- and cascade-system) vapour compression refrigerating systems, when we use it? (Block diagram, T-s and log p-h diagram)

III. Fuel cell
1. What is the working principle of fuel cells? What are the advantages and disadvantages of fuel cells?
2. What are the units of a fuels cell system? What is the role of these units? What type of fuel cells do you know? What characteristic do they have (type of electrolyte, operation temperature, power, efficiency, use)?
3. What H_2 production processes do you know? Describe one in detail!

IV. Internal combustion Engines
1. Describe the Dual-combustion cycle. How can be calculated the cycle efficiency? Show the process in P-V chart. What are the losses in a real internal combustion engines?
2. Describe the characteristic of the ICE engines (Pe, Torque, BSFC and volumetric efficiency in the function of the speed)
3. What are the requirements of the mixing systems? What type of mixture used, and why? Explain Excess air factor Control systems

V. Solar cells
1. How do photovoltaic cells work? Illustrate and explain their I-U, P-U characteristics, along with the effect of irradiance and temperature on the characteristic curves!
2. What is spectral sensitivity, Schockley-Queisser limit and how do multi junction cells work? Which types of Si-based solar cells do you know, and what are their main attributes?

VI. Gas turbines
1. Describe the equation of Compressor input and Turbine output power, how can we calculate the thermal efficiency of gas turbine?
2. What are the losses of Efficiencies and of turbine stages?
3. What are the types of Compressors, what are the main parameters of the types?
4. What are the impulse stage and reaction stage? Draw the velocity triangles of this stages!

VII. ORC
1. What are the differences between ORC and steam turbine cycle?
2. What are advantageous and disadvantages of ORC comparing to the steam turbine?
3. What are the main features of the Rankine cycle fluids?