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SCHOOL OF ENGINEERING
END TERM EXAMINATION - JAN 2023

Semester : Semester V - 2020   **Date :** 11-JAN-2023
Course Code : MEC4003   **Time :** 9.30AM - 12.30PM
Course Name : Sem V - MEC4003 - Applied Thermodynamics   **Max Marks :** 100
Program : B.Tech. Mechanical Engineering   **Weightage :** 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.

PART A

ANSWER ALL THE TEN QUESTIONS   **10 X 2 = 20M**

1. Diesel Engines as compared to Petrol Engines require _____

                                                      (CO1) [Knowledge]

2. Brayton cycle is an air standard cyle for_____

                                                      (CO2) [Knowledge]

3. The work ratio of a closed cycle gas turbine plant depends upon _____.

                                                      (CO2) [Knowledge]

4. The net work output of an ideal regenerative cycle is _____ as compared to the Ideal Rankine Cycle.

                                                      (CO3) [Knowledge]

5. The below diagram is the T-s diagram of the Rankine cycle with reheat. Which process represents the reheat?
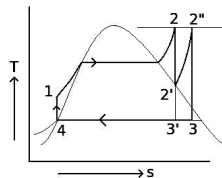
T-s Diagram of Rankine Cycle with Reheat

                                                      (CO3) [Knowledge]

6. What does the effect of the reheat cycle on steam power plant ?

                                                      (CO3) [Knowledge]

7. What is the effect on COP if evaporator pressure is decreased?

(CO4) [Knowledge]

8. What is the relation of all temperatures (T1, T2, T3, T4) in case of Reversed Brayton Cycle? T1 andT3 are intermediate temperatures whereas T2 and T4 are max and minimum temperatures respectively.

(CO4) [Knowledge]

9. Which equipment is replaced in Reversed Brayton Cycle in comparision with Vapor Compression System?

(CO4) [Knowledge]

10. Name different types of expansion device which can be used in Vapor Compression Refrigeration System.

(CO4) [Knowledge]

PART B

ANSWER ALL THE FOUR QUESTIONS   4 X 10 = 40M

11. Dual cycle, or limited pressure cycle, is a thermodynamic cycle that combines the Otto Cycle and the Diesel cycle. In the dual cycle, combustion occurs partly at constant volume and partly at constant pressure. Derive its thermal efficiency and compare it with Otto and Diesel Cycle efficiency.

(CO1) [Comprehension]

12. In order to generate electricity, the gas turbine heats a mixture of air and fuel at very high temperatures, causing the turbine blades to spin. The spinning turbine drives a generator that converts the energy into electricity. In order to get the maximum work output, a optimum pressure ratio is required. Derive the expression for that.

(CO2) [Comprehension]

13. A power cycle continuously converts heat(energy released by the burning of fuel) into work , in which a working fluid repeatedly performs a succession of processes. In the vapour power cycle, the working fluid, which is water, undergoes a change of phase. What is the effect of Reheating and Superheating on efficiency in Vapor Power Cycle? Explain with T-s diagram.

(CO3) [Comprehension]

14. A Brayton cycle that goes in the reverse direction is known as the Reversed Brayton cycle. To move the heat from the colder to the hotter body (by taking the work input), is used by this process. The Brayton cycle is used in some heat engines and it is also known as a thermodynamic cycle. Derive the expression of COP in terms of pressure ratio and specific heat ratio for Reversed Brayton Cycle with neat Block Diagram and T-S Diagram.

(CO4) [Comprehension]

PART C

ANSWER ALL THE FOUR QUESIONS   4 X 10 = 40M

15. An Ideal closed-cycle gas turbine plant is working between temperatures 927 C and 27 C using air as working fluid. The pressure ratio for maximum output is

(CO2) [Application]

16. Water is the working fluid in Rankine cycle. Saturated vapour enters the turbine at 2 MPa. The condenser pressure is 10 kPa. The pump work is negligible. Find out efficiency of the cycle.

P	T (C)	vf (m3/kg)	vg (m3/kg)	hf (kJ/kg)	hg (kJ/kg)	sf (kJ/kg-K)	sg (kJ/kg-K)
2 Mpa	212.42	0.00177	0.09963	908.77	2799.51	2.4473	6.3468
10 Kpa	45.81	0.00101	14.6735	191.81	2584.63	0.6492	8.1501

(CO3) [Application]

17. Air is used as refrigerant in Reversed Brayton Cycle. If the temperature at the end of heat absorption and heat rejection are 0 C and 30 C respectively. The pressure ratio is 4. Determine the temperature at all other points and volume flow rate at compressor inlet and expander outlet for 1 ton capacity. Assume initial pressure as 1 bar (at compressor inlet).

(CO4) [Application]

18. A refrigeration based on ideal VCRS operates between the temperature limits of -20 C and 40 C. the refrigerant enters the condenser as saturated vapor and leaves the condenser as saturated liquid. Find a) COP b) if mass flow rate is 0.025 kg/s then RE (in kW). The enthalpy and entropy values of the refrigerant are given below:

T (C)	hf (kJ/kg)	hg (kJ/kg)	sf(kJ/kg)	sg (kJ/kg
- 20	20	180	0.07	0.7366
40	80	200	0.03	0.67

(CO4) [Analysis]

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