Reg. No. \_\_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **18AE2007** | **Duration :** | **3hrs** |
| **Sub. Name :** | **THERMODYNAMICS** | **Max. Marks :** | **100** |

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| **Q. No.** | **Questions** | **Course Outcome** | **Marks** |
| **PART – A (10X1 = 10 MARKS)** | | | |
| 1. | Draw the positive and negative work interaction diagram. | CO1 | 1 |
| 2. | Celsius temperature of the triple point of water is \_\_\_\_\_\_\_\_\_ (in degree Celsius). | CO1 | 1 |
| 3. | The value of entropy for isentropic process is \_\_\_\_\_\_\_\_\_ . | CO2 | 1 |
| 4. | State Kelvin – Planck’s statement. | CO2 | 1 |
| 5. | Isentropic efficiency of turbine is \_\_\_\_\_\_\_\_\_ . | CO3 | 1 |
| 6. | Define Cp. | CO3 | 1 |
| 7. | Define mole of a substance. | CO4 | 1 |
| 8. | The ideal gas equation is \_\_\_\_\_\_\_\_\_ . | CO4 | 1 |
| 9. | Define stoichiometric air. | CO5 | 1 |
| 10. | Draw Carnot cycle. | CO5 | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | Write the difference between intensive and extensive properties. | CO1 | 3 |
| 12. | Stae the first law of thermodynamics. | CO2 | 3 |
| 13. | Define Isentropic Processes. | CO3 | 3 |
| 14. | Define Avogadro’s law. | CO4 | 3 |
| 15. | State the difference between theoretical and actual combustion. | CO5 | 3 |
| 16. | Define refrigerating effect. | CO6 | 3 |

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| **PART - C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23. Q.No 24 is a Compulsory Question)** | | | | |
| 17. | a. | A mass of gas is compressed in a quasi-static process from 80 kPa, 0.1 m3 to 0.4 MPa, 0.03 m3. Assuming that the pressure and volume are related by *pvn*= constant, find the work done by the gas system. (n=1.34) | CO1 | 7 |
| b. | Derive the expression for work in various quasi-static processes. | CO1 | 5 |
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| 18. | a. | A domestic refrigerator is loaded with food and the door closed. During a certain period the machine consumes 1 kWh of energy and the internal energy of the system drops by 5000 kJ. Find the net heat transfer for the system. | CO2 | 5 |
| b. | A blower handles 1 kg/s of air at 20°C and consumes a power of 15 kW. The inlet and outlet velocities of air are 100 m/s and 150 m/s respectively. Find the exit air temperature, assuming adiabatic conditions. Take C*p* of air is 1.005 kJ/kg-K. | CO2 | 7 |
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| 19. | a. | Water is heated at a constant pressure of 0.7 MPa. The boiling point is 164.97°C. The initial temperature of water is 0°C. The latent heat of evaporation is 2066.3 kJ/kg. Find the increase of entropy of water, if the final state is steam. | CO3 | 7 |
| b. | Explain in detail about the entropy change of pure substance. | CO3 | 5 |
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| 20. |  | A fluid at 200kpa and 300°C has a volume of 0.8 m3. In a frictionless process at constant volume the pressure changes to 100kpa. Find the final temperature and heat transferred (a) if fluid is air, and (b) if the fluid is steam. | CO4 | 12 |
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| 21. |  | An ideal Otto cycle has a compression ratio of 8. At the beginning of the compression process, air is at 100 kPa and 17°C, and 800 kJ/kg of heat is transferred to air during the constant-volume heat-addition process. Accounting for the variation of specific heats of air with temperature, determine (*a*) the maximum temperature and pressure that occur during the cycle, (*b*) the net work output, (*c*) the thermal efficiency, and (*d* ) the mean effective pressure for the cycle. | CO5 | 12 |
| 22. | a. | Derive and explain the simple steady flow energy equation. | CO2 | 9 |
| b. | A piston–cylinder device contains a liquid–vapor mixture of water at 300 K. During a constant-pressure process, 750 kJ of heat is transferred to the water. As a result, part of the liquid in the cylinder vaporizes. Determine the entropy change of the water during this process. | CO3 | 3 |
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| 23. | a. | Draw the Brayton cycle with neat sketch and derive the expression to find the efficiency. | CO5 | 7 |
| b. | Find the enthalpy, entropy, and volume of steam at 1.4Mpa, 380°C. | CO4 | 5 |
|  |  | **Compulsory:** |  | |
| 24. |  | An R-12 vapour compression refrigeration system is operating at a condenser pressure of 9.6 bar and an evaporator pressure of 2.19 bar. Its refrigeration capacity is 15 tonnes. The values of enthalpy at the inlet and outlet of the evaporator are 64.6 and 195.7 kJ/kg. The specific volume at inlet to the reciprocating compressor is 0.082 m3/kg. The index of compression for the compressor is 1.13.  **Determine:**  (a) The power input in kW required for the compressor.  (b) The COP. Take 1 tonnes of refrigeration as equivalent to heat removal  at the rate of 3.517 kW. | CO6 | 12 |