

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019

Course Code: AU202
Course Name: ADVANCED THERMODYNAMICS (AU)

Max. Marks: 100

Duration: 3 Hours

(Use of approved data book is permitted)

PART A

Answer any three full questions, each carries 10 marks.

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|---|---------------------------------------------------------------------------------------|----|
| 1 | a) Differentiate between classical thermodynamics and statistical thermodynamics | 3 |
| | b) Define thermodynamic property. How do you classify the thermodynamic property? | 4 |
| | c) Explain the term "Thermodynamic equilibrium" | 3 |
| 2 | a) Write limitations of thermodynamics | 3 |
| | b) Define the concept of continuum | 3 |
| | c) Describe the assumptions for an ideal gas | 4 |
| 3 | a) Define the term "temperature", explain about any one temperature measuring device. | 5 |
| | b) Show that internal energy is a property of the system. | 5 |
| 4 | a) Derive steady flow energy equation | 10 |

PART B

Answer any three full questions, each carries 10 marks.

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|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 5 | a) State and explain Second law of thermodynamics | 4 |
| | b) A cyclic heat engine operates between a source temperature of 800 °C and a sink temperature of 30 °C. What is the least rate of heat rejection per kW net output of engine?. | 6 |
| 6 | a) Define Clausius inequality. | 5 |
| | b) Differentiate between a heat pump and a refrigerator. | 5 |
| 7 | a) Derive Maxwell's equations using combined first and second law equations | 10 |
| 8 | a) Derive Tds equations using Maxwell's relations | 10 |

PART C

Answer any four full questions, each carries 10 marks.

- 9 a) With neat sketch explain about P-T diagram for a pure substance. 10
- 10 a) A vessel having a capacity of 0.05m^3 contains a mixture of a saturated water and saturated steam at a temperature of 245°C . the mass of the liquid present in 10kg. find the following 10
- (i) the pressure (ii) the mass (iii) the specific volume (iv) the specific enthalpy (v) the specific entropy and internal energy
- 11 a) With the help of P-V and T-S diagram derive an expression for efficiency of Brayton cycle 10
- 12 a) The pressure and temperature at the beginning of compression in an air standard Brayton cycle are 100 kPa and 27°C . The heat added per kg of air 1850 kJ. The compression ratio is 4. Determine the maximum pressure and temperature, thermal efficiency. Assume $\gamma=1.4$, $C_p=1.005\text{ kJ/kgK}$. 10
- 13 a) With the help of P-V and T-S diagram derive an expression for efficiency of Rankine cycle 10
- 14 a) A steam power plant works between pressures of 40 bar and 0.05 bar. If the steam supplied is dry saturated and cycle of operation is Rankine cycle, find 10
- a) Cycle efficiency
- b) Specific steam consumption