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



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – Nov/Dec – 2016**

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|  |  | **Semester :** | **2016-17 ODD** |
| **Code :** | **14ME2014** | **Duration :** | **3hrs** |
| **Sub. Name :** | **ENGINEERING THERMODYNAMICS** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | How does internal energy, enthalpy relates to each other? | CO1 | **1** |
| b. | Describe 2nd law of TD. | CO2 | **1** |
| c. | Explain 1st law of TD for a closed system undergoing a change in state. | CO1 | **2** |
| d. | Write down the steady flow Energy Equation (SFEE). | CO1 | **2** |
| e. | The properties of a closed system change following the relation between pressure and volume as pV = 3.0, where p is in bar V is in m3. Calculate the work done when the pressure increases from 1.5 bar to 7.5 bar. Given 1 bar = 105 N/m2. | CO1 | **14** |
| **(OR)** | | | | |
| 2. | a. | What is the main cause of the irreversibility? | CO1 | **1** |
| b. | What are known as Intensive properties? | CO1 | **1** |
| c. | Explain a PMM1 engine. | CO1 | **2** |
| d. | If the source and sink temperatures are T1,T2, respectively, calculate the efficiency of heat pump and a heat engine | CO1 | **2** |
| e. | Heat leaks into a refrigerator at a rate of 1200 Jule/s. To maintain 7°C internal temperature against 25°C atmosphere, how much power will be required? What is the COP of the refrigerator? | CO1 | **14** |
| 3. | a. | What is unavailable energy in a Carnot cycle? | CO1 | **1** |
|  | b. | When do you refer a thermodynamic system as reversible? | CO1 | **1** |
|  | c. | Explain Kelvin-Planck’s law, which kind of engine can violate this law? | CO1 | **2** |
|  | d. | How the “heat pump” and “heat engine” are different? | CO1 | **2** |
|  | e. | Air at 20°C and 1.05 bar occupies 0.025 m3. The air is heated at constant volume until the pressure is 4.5 bar, and then cooled at constant pressure to original temp. Calculate the net entropy change. Given cv= 0.718 and cp=1.005 kJ/kg K. | CO1 | **14** |
| **(OR)** | | | | |  | Which Phase transition is absent below triple point line in P-V diagram? |
| 4. | a. | What is the entropy change in adabatic process? | CO2 | **1** |
|  | b. | Is entropy change between two state is path dependent? | CO2 | **1** |
|  | c. | How a reversible path can be replaced with reversible adiabatic – isothermal -adiabatic steps combination? | CO2 | **2** |
|  | d. | Explain Clausius inequality statement. |  | **2** |
|  | e. | One kg of water at 0°C is brought into contact with a heat reservoir at 90°C. When the water has reached 90°C, find : (i) Entropy change of water ; (ii) Entropy change of the heat reservoir, given cp=4.187kJ/kg K. | CO2 | **14** |
| 5. | a. | What is critical temperature of water-vapour phase diagram? | CO2 | **1** |
|  | b. | What are the liquid side and steam side saturation points? | CO2 | **1** |
|  | c. | Find Entropy, enthalpy of steam at 1Mpa 325°C. | CO2 | **2** |
|  | d. | Draw a schematic T-S diagram when water is converted to superheated steam. | CO2 | **2** |
|  | e. | Find entropy, enthalpy, dryness fraction for a water-steam mixture having specific volume 0.15 m3/kg at 1 Mpa. | CO2 | **14** |
| **(OR)** | | | | |
| 6. | a. | How does the saturation temp changes with system pressure? | CO3 | **1** |
|  | b. | What is triple point data? | CO3 | **1** |
|  | c. | How will generate Mollier diagram (H-S plot) | CO3 | **2** |
|  | d. | What is superheated steam and what is compressed water? | CO3 | **2** |
|  | e. | What amount of heat would be required to produce 1 kg of steam at a pressure of 0.6 MPa and temperature of 250°C from water at 30°C? Take specific heat for superheated steam as 2.2 kJ/kg K, and water 4.18 kJ/kg K. | CO3 | **14** |
| 7. | a. | Write down relationship between “pv” and “p” in power series form? | CO3 | **1** |
|  | b. | How does van der Wall’s Equation of state takes care about non-ideality? | CO3 | **1** |
|  | c. | Define specific heats, i.e. cp and cv for and ideal gas. | CO3 | **2** |
|  | d. | Derive the value for universal gas constant (in SI unit) from the information that 1 gmol gas volume is 22.4 L at STP. | CO3 | **2** |
|  | e. | 1 kg of air at 0.8 MPa and a temperature of 100°C undergoes a reversible polytropic process following the law pv2 = constant. If the final pressure is 0.18 MPa. Determine the final specific volume, temperature. | CO3 | **14** |
| **(OR)** | | | | |
| 8. | a. | Define partial pressure of a gas in mixture | CO3 | **1** |
|  | b. | What is adiabatic mixing of ideal gases? | CO3 | **1** |
|  | c. | How does the apparent gas constant relates with universal gas constant? | CO3 | **2** |
|  | d. | Calculate apparent molecular weight of air assuming 23% O2 and 77% N2 | CO3 | **2** |
|  | e. | A vessel of 0.35 m3 capacity contains 0.4 kg of carbon monoxide (molecular weight = 28) and 1 kg of air at 20°C. Calculate : (i) The partial pressure of each constituent, (ii) The total pressure in the vessel. | CO3 | **14** |
|  | | **Compulsory:** |  |  |
| 9. | a. | What is due point temperature and wet bulb temperatures? | CO4 | **1** |
|  | b. | Differentiate between specific and relative humidity. | CO4 | **1** |
|  | c. | Deduce the coorelation between specific humidity and partial pressure of water vapour. | CO4 | **2** |
|  | d. | If specific humidity of atmospheric air at 20°C is 0.0095 kg/kg of dry air, calculate partial pressure of water vapor. | CO4 | **2** |
|  | e. | In the same problem above, calculate relative humidity, and dew point temperature. | CO4 | **14** |

ALL THE BEST

**Students are allowed to use the steam-table they have in their possession**