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

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**End Semester Examination – Nov/Dec– 2018**

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| **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. | Describe heat and work interaction with change in internal energy in a closed thermodynamic system with appropriate diagram.  Explain the sign convention adopted to represent work and heat transfer process ‘to’ the system and ‘from’ the system. | CO1 | 10 |
| b. | Elaborate second law of thermodynamics for inter-convention of work and heat in a cyclic heat engine. How is the “efficiency” defined for a cyclic heat engine? | CO1 | 10 |
| (OR) | | | | |
| 2. |  | The volume of a closed system change following the relation between pressure and volume as *pV*= constant, where *p* and *V*are pressure and volume. From an initial volume of 3 m3 and pressure 6 N/m2 , the system getde-pressurized to 2 N/m2.If 5 J heat is also released to surrounding during this expansion.  Calculate the (i) work done and (ii) change in internal energy. | CO1 | 20 |
|  |  |  |  |  |
| 3. | a. | Describe the generalized mass and energy balance equations for steady flow process. | CO1 | 5 |
| b. | In an air compressor air flows steadily at the rate of 0.5 kg/s. It enters the compressor at 6 m/s with a pressure of 1 bar and a specific volume of 0.85 m3/kg and leaves at 5 m/s with a pressure of 7 bar and a specific volume of 0.16 m3/kg. The internal energy of the air leaving is 90 kJ/kg greater than that of the air entering. Cooling water in a jacket surrounding the cylinder absorbs heat from the air at the rate of 60 kJ/s. Calculate the power required to drive the compressor. Given 1 bar = 105 N/m2 | CO1 | 15 |
| (OR) | | | | |
| 4. | a. | State and explain the Kelvin-Planck statement of 2nd law of thermodynamics. | CO1 | 5 |
| b. | A house requires 2×105 kJ/h for heating in winter. Heat pump is used to absorb heat from cold air outside in winter and send heat to the house. Work required to operate the heat pump is 3×104 kJ/h. Determine : (i) Heat abstracted from outside ; (ii) Co-efficient of performance. | CO1 | 15 |
| 5. |  | Air at 40°C and 1.5×105 N/m2 pressure occupies 0. 25 m3. The air is cooled at *constant pressure* to a volume of 0.50 m3, and then heated at *constant volume* until the pressure is 4.5×105 N/m2. Calculate: (i) The net heat flow from the air. (ii) The net entropy change. Mass of air is given 0.04 kg.  Given ***c***v = 0.718 kJ/kg K and ***c***p = 1.0 kJ/kg K | CO2 | 20 |
| (OR) | | | | |
| 6. |  | Nitrogen 0.04 m3 contained in a cylinder behind a piston is initially at 1.05 bar and 15°C. The gas is compressed isothermally and reversibly until the pressure is 4.8 bar. Calculate : (i) The change of entropy, (ii) The heat flow, and (iii) The work done.  Given, gas constant R is 8.314 Nm / mol and *m.w.* of air 28 g/mol | CO2 | 20 |
| 7. |  | A vessel contains a mixture of water and steam at a saturation temperature of 250°C. The mass of the liquid present is 100 kg and steam is 0.1 kg. Calculate capacity of the container. Also, calculate enthalpy of the mixture. | CO3 | 20 |
| (OR) | | | | |
| 8. | a. | Write down the ‘equation of state’ for an ideal gas. How does the Van der Waals’ equation modify the relationship? How is the compressibility factor defined for a ‘real’ gas? | CO3 | 10 |
| b. | A vessel of 0.03 m3 capacity contains 1 kg N2 gas at 1 bar pressure. Determine the mass of the gas in the vessel. If the pressure of this gas is increased to 10 bar while the volume remains constant, what will be the temperature of the gas? R is 8.314 J / mol and 1 bar = 105 N/m2 | CO3 | 10 |
|  | | **Compulsory**: |  |  |
| 9. | a. | Deduce the relationship between specific humidity and Partial pressure of water vapor. | CO3 | 5 |
|  | b. | The atmospheric conditions at 20°C, specific humidity of dry air is 0.01 kg/kg. Calculate:(i) Partial pressure of vapour (ii) Relative humidity, (iii) Dew point temperature. | CO3 | 15 |