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



**End Semester Examination – Nov/Dec– 2017**

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

{{}}}}

(for Biotech only)

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. |  | An engine cylinder has a piston area of 0.12 m2 and contains a gas at a pressure of 1.5 MPa. The gas expands according to straightline in p-v diagram. The final pressure is 0.15 MPa. Calculate the work done by the gas if stroke is 0.3 m. | CO1 | 20 |
| (OR) | | | | |
| 2. |  | Internal energy of a system is given by *u*=3.56 *pv*+ 84**,** where *u* is given as kJ/kg, *p* in kPa, *v* is in m3/kg. The system is composed of 3 kg substances that expands from initial pressure 500 kPa, 0.22 m3 to 100 kPa in a process where *pv*1.2 = constant. Calculate the Q, ΔU, W for the process. | CO1 | 20 |
|  |  |  |  |  |
| 3. | a. | Illustrate operational differences between heat-engine and heat-pump with schematic diagram. | CO1 | 5 |
|  | b. | Two reversible heat engine A, B are arranged in series, A rejecting heat to B. Engine A receives 200 kJ at a temperature 421°C, while engine B rejects at 4.4°C. If the work output of A is twice that of B, find the intermediate temperature between A and B, and heat rejected to cold sink. | CO1 | 15 |
| (OR) | | | | |
| 4. |  | A heat pump working on a carnot cycle takes in heat from a reserviorat 5°C and delivers at 60°C. The heat pump is driven by a reversible heat engine which takes in heat from a reservoir at 840°C and rejects heat to 60°C. The reversible engine also drives a 30 kW machine. If the heat pump takes 17kJ/s from 5°C reservoir, calculate heat supply from 840°C source and rate of heat rejection to 60°C. | CO1 | 20 |
|  |  |  |  |  |
| 5. | a. | Derive the coorelation for any thermodynamic cycle. | CO2 | 6 |
|  | b. | One kg of water at 273K is brought in contact with heat reservoir 373K. When the water temperature reached 373K, calculate entropy change of water, heat reserver and universe. | CO2 | 14 |
| (OR) | | | | |
| 6. |  | One kg of ice at -5°C is exposed to 20°C atmosphere. Ice melts and comes into thermal equilibrium. Determine, the entropy change in universe. Given *cp* of ice and water as 2.09kJ/kg K and 4.18 kJ/kg K and latent heat of fusion 333 kJ/kg. | CO2 | 20 |
|  |  |  |  |  |
| 7. | a. | Describe the equation of state for an ideal gas and estimate the value of universal gas constant. | CO2 | 8 |
|  | b. | Two vesslels, A, B both containing nitrogen are connected by a valve, when openened reached an equilibrium temperature 27°C. Calculate final equilibrium pressure of the system. Before mixing, following informations are given: ***Vessel A***: *p*= 1.5 Mpa, t = 50°C, content = 14 kg; ***Vessel B***: *p*= 0.6Mpa, t = 20°C, content = 2.5 kg. | CO2 | 12 |
| (OR) | | | | |
| 8. | a. | A rigid closed tank of volume 3 m3 contains 5 kg of wet steam at a pressure of 232 kPa. The tank is heated until it becomes dry saturated. Determine the final pressure, temperature and heat transfer to the tank. | CO3 | 15 |
|  | b. | Draw saturation curve on T*-*Sdagram. Highlight the regions for compressed liquid and superheat steam. | CO3 | 5 |
|  | |  |  |  |
|  | | **Compulsory:** |  |  |
| 9. |  | An air-watervapour mixture at 0.1 MPa, 30°C, 80% RH has a volume of 50 m3. Calculate specific humidity, dew point temperature, mass of dry air, and mass of water vapour. | CO3 | 20 |

ALL THE BEST