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PRESIDENCY UNIVERSITY BENGALURU

SCHOOL OF ENGINEERING

MAKE UP EXAMINATION -JULY 2024

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| **Semester :III** | **Date :5 July 2024** |
| **Course Code :MEC4001** | **Time :9.30 am to 12.30 pm** |
| **Course Name :Basic Thermodynamics** | **Max Marks :100** |
| **Program :B.Tech** | **Weightage :50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

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| **PART A** | | | |
| **ANSWER ANY 4 QUESTIONS 4Q X 5M=20M** | | | |
| 1 | Define heat and work with reference to thermodynamic point of view and also the sign convention of heat and work | (CO 1) | [Knowledge] |
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| 2 | Define Open system, Closed system and Isolated system with and practical example in each case. | (CO 1) | [Knowledge] |
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| 3 | A ideal gas (specific heat constant pressure 1000 J/kg.K) enters and leaves a gas turbine with the same velocity. The temperatures of the gas at turbine entry and exit are 1100 K and 400K. respectively. The power produced is 4.6 MW and heat escapes at the rate of 300 kJ/s through the turbine casing. Find the mass flow rate of the gas (in kg/s) through the turbine. Also draw diagram showing inlet and outlet points clearly. | (CO 1) | [Knowledge] |
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| 4 | Write Steady Flow Energy Equation for turbine assuming turbine to be adiabatic. Also draw diagram showing all points clearly | (CO 1) | [Knowledge] |
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| 5 | Explain Zeroth law of thermodynamics with neat and clean diagram. | (CO 1) | [Knowledge] |
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| 6 | Explain the following terms:   1. System b) Surrounding c) Universe | (CO 1) | [Knowledge] |
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| **PART B** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** | | | |
| 7 | Derive the equation for entropy change for ideal gas. m=mass , R= characteristic gas constant, Cp= Specific heat at constant Pressure.    Subscript 1 is initial state and 2 is final state. | (CO3) | [Comprehension] |
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| 8 | What will be entropy change for a system when it undergoes reversible heat addition, reversible heat rejection and zero heat transfer. Prove your answer with help of equation | (CO3) | [Comprehension] |
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| 9 | Prove that the slope of constant volume line is greater than slope of constant pressure line on Temperature Entropy diagram. (First derive the slope of both lines). | (CO3) | [Comprehension] |
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| 10 | Explain sub-cooled region, wet region and super heated region on temperature(T) entropy(S) axis. Define each region with help of T-S Diagram Define Heat engine, Heat Pump and Refrigerator with line diagram. What is relationship between heat pump and refrigerator. | (CO3) | [Comprehension] |
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| 11 | Define Heat engine, Heat Pump and Refrigerator with line diagram. What is relationship between heat pump and refrigerator. | (CO3) | [Comprehension] |
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| 12 | Explain Kelvin-Plank Statement for second law of thermodynamics. Also prove its equivalence relation | (CO3) | [Comprehension] |
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| 13 | Explain Four consequences of First law of Thermodynamics with equation | (CO3) | [Comprehension] |
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| **PART C** | | | |
| **ANSWER ANY 2 QUESTIONS 2Q X 15M=30M** | | | |
| 14 | a) One kg of air (R=287J/kgK) undergoes an irreversible process between equilibrium state 1(20 degree C,0.9 ) and equilibrium state 2(20 degreeC,0.6 ). Find the change in entropy (s2−s1 (in J/kgK) )  b). Find the thermal efficiency of the hypothetical heat engine cycle shown in the fig. b | (CO4) | [Application] |
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| 15 | A vessel of volume 1.0  contains a mixture of liquid water and steam in equilibrium at 1.0 bar. Given that 90% of the volume is occupied by the steam, find the dryness fraction of the mixture. Assume at 1.0 bar, vf = 0.001  /kg and vg = 1.7  /kg. Where vf= specific volume of saturated liquid, vg= specific volume of saturated vapour. Also plot temperature entropy diagram showing the pressure line and the point showing dryness fraction | (CO4) | [Application] |
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| 16 | A mass of 5 kg of liquid water is cooled from 100°C to 20°C. The ambient temperature is 25 degree celcius. The specific heat of water is 4.2 kJ/kg-C. Find.....   * + - 1. Entropy change of water       2. Entropy change of surrounding.       3. Entropy change of Universe | (CO4) | [Application] |
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