**20ME304**

**Hall Ticket Number:**

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| **II/IV B.Tech (Regular) DEGREE EXAMINATION** | | | |
| **March, 2022** | **Mechanical Engineering** | | |
| **Third Semester** | **Engineering Thermodynamics** | | |
| **Time:** Three Hours | | **Maximum: 7**0 Marks | |
| *Answer Question No.1 compulsorily.* | | | (14X1 = 14 Marks) |
| *Answer ONE question from each unit.* | | | (4X14=56 Marks) |
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| 1. | a) | | Differentiate closed and open system. | CO1 |  |
|  | b) | | How do you classify the properties? | CO1 |  |
|  | c) | | Define thermodynamic equilibrium. | CO1 |  |
|  | d) | | Define Specific heat. | CO2 |  |
|  | e) | | What is the state of First law thermodynamics? | CO2 |  |
|  | f) | | Apply Steady Flow Energy Equation to the Nozzle. | CO2 |  |
|  | g) | | Define: PMM of first kind. | CO3 |  |
|  | h) | | What is the difference between a heat pump and a refrigerator? | CO3 |  |
|  | i) | | Determine the exit velocity from a nozzle with the enthalpy drop 500 kJ/kg with an initial velocity 10 m/sec. | CO3 |  |
|  | j) | | What is the Principle of increase of entropy? | CO3 |  |
|  | k) | | Write the availability function for non-flow process. | CO4 |  |
|  | l) | | Draw the P-V and T-S diagram for Dual cycle. | CO4 |  |
|  | m) | | Define mean effective pressure. | CO4 |  |
|  | n) | | What is the function of spark-plug? | CO4 |  |
| **Unit – I** | | | | | |
| 2. | a) | Differentiate between microscopic and macroscopic approach. | | CO1 | 7M |
|  | b) | A mass of 8 kg gas expands within a flexible container so that the p–v relationship is pvl.2 = constant. The initial pressure is 1000 kPa and the initial volume is 1 m3. The final pressure is 5 kPa. If specific internal energy of the gas decreases by 40 kJ/kg, find the heat transfer in magnitude and direction. | | CO1 | 7M |
| **(OR)** | | | | | |
| 3. | a) | Explain Quasi-static process. | | CO1 | 7M |
|  | b) | 90kJ of heat is supplied to a system at a constant volume then the system rejects 95kJ of heat at constant pressure and 18kJ of work on it. Then the system is brought to original state by adiabatic process. Determine (i) the adiabatic work (ii) the values of internal energy at all end states if the initial value of internal energy is 105kJ. Draw the P-V diagram. | | CO1 | 7M |
| **Unit – II** | | | | | |
| 4. | a) | What are the limitations of first law of thermodynamics? | | CO2 | 7M |
|  | b) | Derive an expression for steady-flow energy equation of a turbine and compressor. | | CO2 | 7M |
| **(OR)** | | | | | |
| 5. | a) | Prove the equivalence of Kelvin Planck and Clausius Statements of second law of thermodynamics. | | CO2 | 7M |
|  | b) | Carnot cycle operate between source and sink temperatures of 2500C and -150C. If the system receive 90kJ from the source. Find (i) efficiency of the system (ii) the network transfer (iii) heat rejected to the sink. | | CO2 | 7M |
| **Unit – III** | | | | | |
| 6. | a) | Show that for an ideal gas entropy change is  S2-S1=Cpln (V2/V1)+Cvln (P2/P1) | | CO3 | 7M |
|  | b) | State and explain Clausius Inequqlity. | | CO3 | 7M |
| **(OR)** | | | | | |
| 7. | a) | Derive an expression for maximum work of a closed system. | | CO3 | 7M |
|  | b) | A heat engine operates between two thermal reservoirs at 900K and 300K. The heat supplied to the engine is 900kJ. The work output is 400kJ. Find the irreversibility. | | CO3 | 7M |
| **Unit – IV** | | | | | |
| 8. | a) | Derive air standard efficiency for diesel cycle with PV and TS diagrams. | | CO4 | 7M |
|  | b) | An air standard Otto cycle has a compression ratio of 7. At the start of the compression, pressure and temperature are 1 bar and 270C. If the maximum temperature of the cycle is 7270C, calculate: i) Heat supplied, ii) Network iii) Thermal efficiency. | | CO4 | 7M |
| **(OR)** | | | | | |
| 9. | a) | Explain the working principle of 4-Stroke diesel engine with neat sketch. | | CO4 | 7M |
|  | b) | Differentiate between 4-stroke and 2-stroke engines. | | CO4 | 7M |

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