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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. (AERONAUTICAL/AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATION, JANUARY 2022

SUBJECT: THERMODYNAMICS [AAE 2158] – Part B

REVISED CREDIT SYSTEM

(29/01/2022)

Time: 75 min

MAX. MARKS: 20

Instructions to Candidates:

- ❖ Answer all the questions.
- ❖ Missing data may be suitable assumed.
- ❖ Steam Table and Psychrometric chart can be used, if necessary.

1A.	In a water cooling tower air enters at a height of 1 m above the ground level and leaves at a height of 7m. The inlet and outlet velocities are 20 m/s and 30 m/s respectively. Water enters at a height of 8 m and leaves at a height of 0.8m. The velocity of water at entry and exit are 3 m/s and 1 m/s respectively. Water temperature are 80 ⁰ Celsius and 50 ⁰ Celsius at the entry and exit respectively. The air temperature is 30 ⁰ and 70 ⁰ Celsius at entry and exit respectively. The cooling tower is well insulated and a fan of 2.25kW drives the air through the cooler. Find the amount of air required (in kg/s) for each kg/s of water flow. Given $C_p=1.005\text{kJ/kg K}$ and 4.187 kJ/kg K for air and water respectively.	04
1B.	A mass of 1.5 kg of gas is to be compressed from 100kPa to 700kPa pressure through $Pv=\text{constant}$ relation. Initial density of gas is 1.15kg/m^3 . Find the work needed to complete the compression process. Show the process in a neat P-v diagram.	03
1C.	Draw a neat sketch indicating heating, vaporization and super heating process for water with all salient points marked on it.	03
2A.	In petrol engine working on Otto cycle, the compression ratio is 7 and the compression begins at 35 ⁰ Celsius and 100kPa pressure. The temperature reached at the end of combustion is 1100 ⁰ C. Find a) temperature and pressures at the end of all the processes constituting the cycle. b) heat supplied and work done in the cycle c) draw a neat PV diagram indicating all the salient point.	05
2B.	A cold storage is to be maintained at -5 ⁰ Celsius while surrounding air is at 35 ⁰ Celsius. The heat from the surrounding leaks into cold storage at a rate of 35kW. Actual COP of the refrigerator is 1/3rd of ideal COP for the given temperatures. Find the power required to run the compressor of the refrigerator	03
2C.	With a neat sketch briefly enumerate regeneration process in Brayton cycle	02