BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2024)

CLASS: BTECH **SEMESTER : IIIrd**
BRANCH: PIE **SESSION : MO/2024**

SUBJECT: ME289 THERMAL AND FLUID ENGINEERING

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1	Write short notes on (a) Zeroth law of thermodynamics (b) Quasi-equilibrium process (c) Ideal gas equation of state (d) Refrigerator and heat pump	[5]	1	1
Q.2(a)	Explain the reversed heat engine.	[3]	2	2
Q.2(b)	Can the Brayton cycle be used in reciprocating engines? Justify your answer.	[2]	2	2
Q.3(a)	Compare heat and work.	[1]	2	1
Q.3(b)	Consider a gas contained in a piston–cylinder assembly as the system. The gas is initially at a pressure of 1000 kPa and occupies a volume of 0.1 m^3. The gas is taken to the final state where pressure is equal to 200 kPa, by the following two different processes. (i) The volume of the gas is inversely proportional to the pressure. (ii) The process follows the path $PV^{1.4}$ = constant. Calculate the work done by the gas in each case.	[4]	4	4
Q.4(a)	Explain the Carnot theorem.	[1]	2	1
Q.4(b)	Steam flows steadily through a turbine at the rate of 0.42 kg/sec. The steam enters the turbine at the following state: pressure 1.2 MPa, temperature 188˚C, enthalpy 2785 kJ/kg, velocity 33.3 m/sec and elevation 3 m. The steam leaves the turbine at the following state: pressure 20 kPa, enthalpy 2512 kJ/kg, velocity 100 m/sec and elevation 0 m. Heat is lost to the surroundings at the rate of 0.29 kJ/kg. Calculate the power output of the turbine.	[4]	3	3
Q.5	A spark-ignition engine working on air standard Otto cycle, the compression ratio is 7, and compression begins at 35˚C, 100 kPa. The maximum temperature of the cycle is 1100˚C. Find (a) temperature and pressure after the expansion stroke of the cycle, (b) the heat supplied per kg of air (c) the cycle efficiency, (d) the work done per kg of air. Where C_p= 1.005 kJ/kg. K and C_v = 0.718 kJ/kg. K.	[5]	4	4

::::::24/09/2024::::::E