09-06-2026 SE MECHANICAL SEM-III (NEP-2020) THERMO. QP CODE: 20015352

Duration: 2 Hours **Marks: 60**

Q.1	**Attempt Any three (5 marks each)**	**15 Marks**
a.	Explain the types of Thermodynamic System with examples.	**5**
b.	Explain the difference between Heat engine, Heat Pump and Refrigerator.	**5**
c.	Explain Joule -Thomson Coefficient.	**5**
d.	Explain the Phase change process of water with diagram.	**5**
e.	Explain the Brayton Cycle with the help of schematic diagram and draw the PV Diagram and TS diagram for Brayton Cycle.	**5**
Q.2		**15 Marks**
a	Explain the Clausius Statement and Kelvin- Planck Statement of the second law of thermodynamics with help of diagram	**5**
b	A Carnot heat Engine which operates between temperature levels of 927 ^{0}C and 33 ^{0}C rejects 30 KJ to the low temperature sink. The Engine drives a Heat Pump which receives 270 KJ of Heat from a low temperature reservoir and rejects it to the surrounding at 33 ^{0}C. Determine the temperature of the reservoir from which the heat pump receives the heat.	**10**
Q.3		**15 Marks**
a.	Explain why Entropy is property of a system.	**5**
b.	1 kg of air at 500 K is heated reversibly at constant Pressure to 2000 K. Find the Available Energy and the Unavailable Energy.	**10**
Q.4		**15 Marks**
a.	Define wet steam, dry steam, superheated steam, dryness fraction, T-S and H-S diagram for pure substance.	**5**
b.	Find the Enthalpy of 1 Kg of steam at 12 bar pressure when i. Steam is Dry Saturated ii. Steam is 22 % wet. Determine using steam table	**10**
Q.5		**15 Marks**
a.	Explain Reheat Rankine Cycle with suitable T-S diagram	**5**
b.	Derive the equation to find the thermal efficiency for Otto cycle.	**10**
Q.6		**15 Marks**
a.	Explain in brief Sonic velocity and Mach number for Compressible fluid flow.	**5**
b.	In an air standard Otto Cycle that has a heat addition of 2800 KJ/Kg of air, a compression ratio of 8 and a pressure and temperature at the beginning of compression process of 1bar, 300 K. Determine a. The Maximum pressure and temperature in the Cycle b. The Thermal Efficiency Take C_p=1.005 KJ/KgK , C_v=0.718 KJ/KgK ,R= 287 J/KgK	**10**

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