TME-302

Roll No.

(ODD SEM) Examination 2019-20
B.TECH. Semester IIIrd
MECHANICAL/AUTO/PLASTIC & POLYMER
Engineering Thermodynamics

Time: 2 Hrs.   Total Marks: 50

Total no. of printed pages: 1

Note: Attempt all questions.

Q.1 Answer any three of the following: (4 x 3)
(a) Give the concept of first law of thermodynamics. What are its limitations?
(b) Explain steady flow energy equation. Apply this equation for adiabatic expansion of steam through nozzle and compression of air through a compressor
(c) Define adiabatic process and develops an expression for work done by a gas during its adiabatic expansion.
(d) Define availability and develop an expression for maximum work developed in a reversible process.

Q.2 Answer any three of the followings: (4 x 3)
(a) Explain joule Kelvin effect with a neat sketch of throttling process. Prove that Joule Thomson coefficient $\mu = 0$ for an ideal gas.
(b) What do you understand by high grade energy and low grade energy? Give any four examples of each type.
(c) What is condition for exact differential? Derive Maxwell's Equation.
(d) Calculate the available energy in 80 kg of water at 50^0C with respect to surrounding at 5^0C. The pressure of water being 1 atm.

Q.3 Attempt any two of the following: (6.5 x 2)
(a) Explain Joule-Kelvin effect? What is inversion curve, show it on T-P diagram.
(b) Define ή of a reversible heat engine. Draw Carnot cycle on (P-V) & (T-S) diagram and develop an expression for ή of Carnot heat engine cycle
(c) Define available and unavailable energy. Explain available energy referred to a cycle.

Q.4 Answer any two of the following: (6.5 x 2)
(a) Compare Otto, Diesel and Dual cycles on the basis of same compression ratio and heat input. Draw cycles on P-V and T-S diagram.
(b) m_1 kg of water at T_1 is isobarically and adiabatically mixed with m_2 kg of water at T_2, where $T_1>T_2$. Show that for equal masses of water, entropy change of mixture is given by

$$dS(universe) = 2\, mc_p \log_e \left(\frac{T_1 + T_2}{\sqrt{T_1.T_2}}\right)$$

(c) Discuss the working of a centrifugal compressor with a neat sketch. What is difference in principle of working of it and axial flow compressor?