sem IV / Applied Thermodynamics / PROD/CBGS/A.Thermo/IV
06.06.16

Q. P. Code : 559801

(03 Hours) Total Marks: 80

N.B.: 1. Question No. **1** is **compulsory.**
2. Attempt **any three** questions out of remaining **five** questions.
3. Assume suitable data wherever required.
4. Assumptions made should be stated clearly.

Q.1 a) What are the similarities and differences between heat and work. 05
b) State and explain second law of thermodynamics. 05
c) What are the basic components of a steam power plant? Enumerate the function of each component. 05
d) Draw P-v and T-s diagram of dual and Brayton cycle. 05

Q.2 a) A cylinder contains 1 kg of gas at an initial pressure of 20 bar. The gas is allowed to expand reversible adiabatically up to 100kPa and then at constant pressure until the piston regains its original position, heat Is then supplied reversibly with the piston firmly locked in position until the pressure rises to the original value of 20 bar. Calculate the net work done by the gas, for an initial volume of 0.5 m^3. 10
b) Air at 1 bar pressure, 290K temperature flows steadily at the rate of 120 kg/hr into a compressor where its pressure and temperature are respectively raised to 15 bar and 390K. During the compression process, the heat transfer from the compressor is 10 percent of work transfer. Neglecting changes in kinetic energy and potential energy, evaluate the work and heat interactions. 10

Q.3 a) i) State and explain zeroth law of thermodynamics
ii) Define path function and point function with example. 10
b) What is a heat pump? How does it differ from a refrigerator? Show that COP of heat pump is greater than COP of a refrigerator by unity. 10

Q.4 a) i) Write short note on PMM-I and PMM-II.
ii) Define availability, dead state and irreversibility. 10
b) 1m^3 of air is heated reversibly at constant pressure from 290 K to 580 K, and is then cooled reversibly at constant volume back to initial temperature. If the initial pressure is 1 bar, work out the net heat flow and overall change in entropy. Represent the processes on T-S plot. 10

Q.5 a) i) Explain in detail the critical point and triple point.
ii) What is cut off ratio? How does it affect the thermal efficiency of Diesel cycle? 10
b) A steam turbine of a power plant operating on ideal Rankine cycle is supplied with dry saturated steam at 25 bar, and the exhaust takes place at 0.2 bar. For the rate of 10 kg/s. Determine i) Quality of steam at the end of expansion ii) Turbine shaft work. iii) Power required to drive the pump iv) work ratio v) Rankine efficiency and vi) heat flow in the condenser. 10

Q.6 a) A vessel of volume 0.04m^3 contains a mixture of saturated water and saturated steam at a temperature of 250°C. The mass of the liquid present is 9 kg. Find the pressure, mass, specific volume, enthalpy, entropy and internal energy. 10
b) Derive the expression for air standard efficiency of Dual cycle. 10
