School of Mechanical Engineering

Mechanical Engineering
ETE - Jun 2023

Time : 3 Hours **Marks : 100**

Sem IV - G3UB401T / BTME3021
Applied Thermodynamics
Your answer should be specific to the question asked
Draw neat labeled diagrams wherever necessary

1.	Explain the Inversion curve.	K2 CO1	(5)
2.	Explain: $\left(\frac{\partial p}{\partial T}\right)_v = \left(\frac{\partial s}{\partial v}\right)_T$	K2 CO1	(5)
3.	Derive the equation: $\left(\frac{\partial T}{\partial p}\right)_s = \left(\frac{\partial v}{\partial s}\right)_p$	K2 CO1	(5)
4.	Which gives more efficient reheat or regenerative in the Rankine cycle while taking the same parameters. Explain in details	K2 CO2	(10)
5.	Dry saturated steam at 17.5 bar enters the turbine of a steam power plant and expands to the condenser pressure of 0.75 bar. Determine the Carnot and Rankine cycle efficiencies.	K3 CO2	(10)
6.	Explain the Introduction to the principles of jetpropulsion	K3 CO4	(10)
7)	Explain the enthalpy, sensible heat, superheated and latent heat while forming the steam with diagrams.	K3 CO4	(10)
	OR		
	Explain Gas turbine cycles with inter-cooling with the help of diagrams.	K3 CO4	(10)
8.	The % mass composition of fuel is Carbon 85, Hydrogen 5.5, Oxygen 5.0, Nitrogen 2.0, Sulpher = 0.5, the remaining being ash. Estimate the minimum mass of air required for the complete combustion of one kilogram of this fuel and the composition of dry products, by volume, if supplied the 40 percent excess air.	K3 CO3	(15)
9.	The combustion products have the following volumetric analysis (dry basis): carbon dioxide 10.89%, Carbon mono oxide 3.63%, Oxygen 3.63%, and Nitrogen 81.85% by burning Acetylene with air. Estimate the actual A/F ratio and the % excess air.	K4 CO3	(15)
10)	A Rankine steam power plant uses water as the working fluid. Steam enters the turbine at 8 MPa and 550 oC and is condensed in the condenser at a pressure of 11 kPa by running cooling water from a lake through the tubes of the condenser at a rate of 1600 kg/s. The cycle has a net power output of 40 MW. The isentropic efficiency of the turbine is 85 percent, and the isentropic efficiency of the pump is 90 percent. Consider that no pressure losses in the condenser and boiler, estimate the thermal efficiency.	K4 CO5	(15)
	OR		
	Consider a steam power plant that operates on a simple ideal Rankine cycle. Steam enters the turbine at 7 MPa and 450 degree C and is condensed in the condenser at a pressure of 10 kPa by running cooling water from a lake through the tubes of the condenser at a rate of 1600 kg/s. The Rankine cycle has a net power output of 40 MW. Show the cycle on the T-S diagram with respect to saturation lines, and determine the thermal efficiency of this cycle,	K4 CO5	(15)