CHAPTER 6

CONCLUSIONS AND SCOPE FOR FUTURE WORK

6.1 CONCLUSIONS

Thermodynamic analysis of Fuel Cell based Gas Turbine Combined Cycle Power Plant has been done out for different fuels and the following conclusions are derived from the investigation:

- Fuel Cell based Combined Cycle Power Plants have about 23% higher efficiency than those of recuperated gas turbine power plants, because of less exergy losses of combustion (Section 5.1).
- An increase in Pressure Ratio reduces the rate of exergy destruction of the plant and results in higher second law efficiency (Figure 5.3).
- An increase in turbine inlet temperature and ambient temperature of air results in higher rate of exergy destruction of the plant.
- The thermal and exergy efficiencies of fuel cell based combined cycle, are found to be increasing first and then decreasing with the increase in pressure ratio and an optimum pressure ratio is identified, where the efficiencies are maximum and their values are 9 and 7 respectively for SOFC and MCFC based plants (Figure 5.35).
- From the thermodynamic analysis of two systems, it has been observed that the better energy and exergy efficiencies can be
obtained when the methane is used as fuel, when compared to natural gas, coal gas and ethanol (Figure 5.1).

- Exergy analysis of each component provides better understanding of irreversibilities and found that the total irreversibilities are more, when the ethanol is used as fuel (Figure 5.13).

6.2 SCOPE FOR FUTURE WORK

The present work is an attempt to model the basic Gas Turbine - Fuel Cell Combined Cycle Power Plant for different fuels. This work can be further extended in the following directions.

1) The Performance of the system can be further improved by adopting inter cooling in between two compressors, if the air is compressed in the low pressure and high pressure compressor

2) The performance of the system can also be improved by reheating the exhaust gases in between two turbines i.e. Gas turbine which drives the compressor and the power turbine

3) Economic analysis of Gas Turbine - Fuel Cell combined Cycle Power Plant can be carried out to find unit cost for power generation.

4) Though Gas Turbine - Fuel Cell hybrid systems are costlier, experimental work can be carried out starting with low capacities. BHEL has already started 5KW SOFC power systems experimentation.