A DISSERTATION ON

EXERGY ANALYSIS OF COMBINED CYCLE POWER PLANT

Submitted in partial fulfilment of the requirement

For the award of the degree of

Master of Technology

In

Thermal Engineering

Submitted By

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CERTIFICATE

It is certified that Mahendra Kumar Pandey, Roll No. 2K12/THR/13, student of M.Tech. Mechanical Engineering, Delhi Technological University, has submitted the dissertation titled "**Exergy Analysis of combined cycle power plant**" under our guidance towards the partial fulfillment of the requirements for the award of the degree of Master of Technology.

He has developed a mathematical computational model for performing the energy and exergy analysis of the combined cycle using EES software. His work is found to be satisfactory and his discipline impeccable during the course of the project. His enthusiasm, attitude, towards the project is appreciated.

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CANDIDATE'S DECLARATION

I hereby declare that the work which is being presented in this project report entitled **"EXERGY ANALYSIS OF COMBINED CYCLE POWER PLANT"** submitted as major project towards the fulfilment of the requirements for the award of the degree of Master of Technology with specialization in Thermal Engineering, D.T.U. Delhi, is an authentic record of my own work carried out under the supervision of ***Prof. R. S. Mishra*** **and** ***Dr. Rajesh Kumar*** Mechanical Engineering Department, at Delhi technological university, Delhi.

The matter embodied in this dissertation report has not been submitted by me for the award of any other degree.

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Generally, individuals set aims but more often than not, their conquest are by the efforts of not just one but many determined people. This complete project could be accomplished because of contribution of a number of people. I take it as a privilege to appreciate and acknowledge the efforts of all those who have, directly or indirectly, helped me achieving my aim.

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ABSTRACT

The performance of Thermal power plant is evaluated by the exergetic performance criteria, which is basically based on the second law of thermodynamics including thermal Efficiency**.** The real useful energy loss cannot be determined by the first law of thermodynamic, because it does not differentiate between the quality and quantity of energy. In this analysis major losses occurs in combustor and exergy destruction is also shown in various parts of the power plant. There are two important criteria in the exergy analysis: Exergetic efficiency and exergy destruction. An important application of exergetic efficiency is the assessment of thermodynamic performance of component or system relative to the performance of a similar one. The results show that the greatest exergy loss in the gas turbine occurs in the combustion chamber due to its high irreversibility. As the second major exergy loss is in HRSG, the optimization of HRSG has an important role in reducing the exergy loss of total combined cycle. The results show that the combustion chamber, gas turbine and heat recovery steam generator (HRSG) are the main sources of irreversibility. The results show that the greatest exergy loss in the gas turbine occurs in the combustion chamber due to its high irreversibility. The exergy losses in different vital components of power plants have been observed and a relative possible improvement in the components has been observed. The improvement in these components provides a wide space of improvement for researchers and academicians in the power plant.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF SYMBOLS

C_p	Specific heat
ST	Steam turbine
GT	Gas turbine
$\dot{I}$	Rate of exergy loss
$\dot{Q}$	Rate of heat transfer (kW)
$\dot{W}$	Work rate (kW)
$\dot{ED}$	Exergy destruction rate (kW)
$\dot{X}$	Exergy rate (kW)
$\dot{X}^Q$	Rate of thermal exergy flow rate (kW)
$\dot{m}_r$	Mass flow rate of refrigerant (kg/s)
T	Temperature (K)
s	Specific entropy (kJ/kg-K)
h	Specific enthalpy (kJ/kg)
comp	Compressor
comb	Combustor
HRSG	Heat recovery steam generator
Exh	Exhaust