

## **CHAPTER 3**

### **RESEARCH METHODOLOGY**

The research methodology flowchart is illustrated as per figure 3.1. The detailed explanation of the research methodology is:

1. Keep on collecting relevant literature review documents from valid resources. Study previous appropriate mathematical models of steam jet ejector reflecting the flow of regimes.
2. Identify the operating parameters of the steam jet ejector.
3. Set necessary assumptions for development of a one-dimensional mathematical model of the steam jet ejector.
4. Develop a mathematical model relating the parameters of the steam jet ejector.
5. Validate the mathematical model with actual values from an existing case study or any literature material related to the scope of study. If the results are not satisfying, rectify the assumptions and re-develop the mathematical model. Repeat the process until achieving a nearly resemblance to the actual data from the case study/literature material.
6. Identify the optimum operating conditions for the steam jet ejector based on the derived mathematical model by using parametric study.

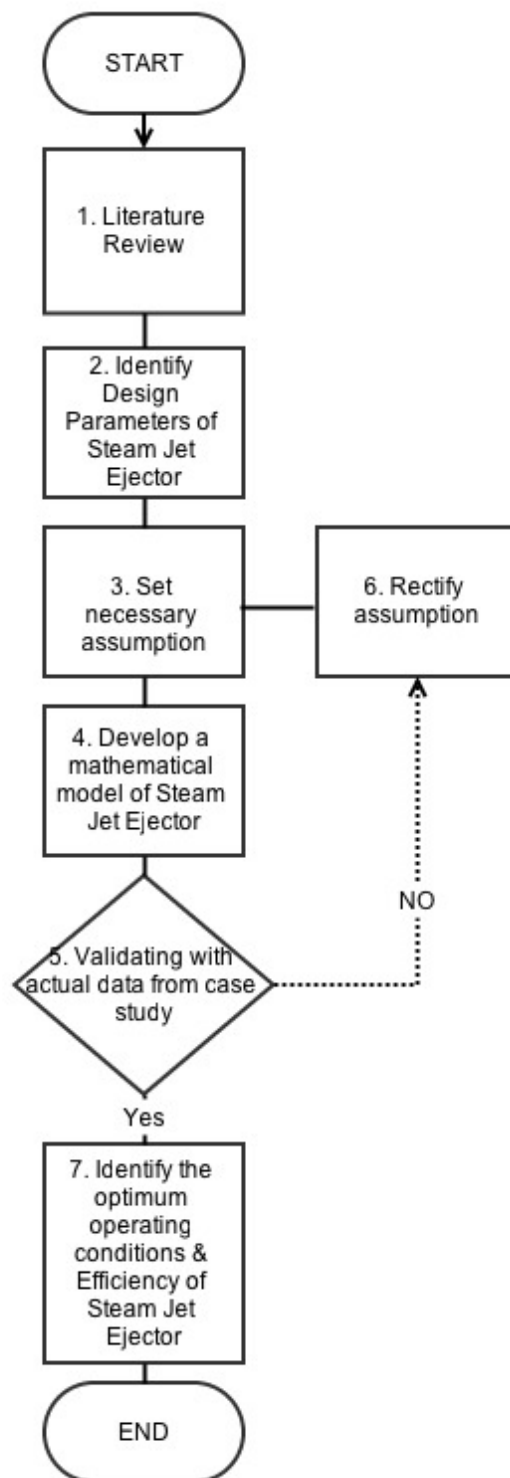


FIGURE 3.1 shows the methodology chart

### **3.1 KEY MILESTONES**

The key milestones are,

1. Identify the parameters of the steam jet ejector.
2. Set necessary assumptions for development of the mathematical model.
3. Develop a one-dimensional mathematical model relating the parameters of the steam jet ejector.
4. Validate the mathematical model with actual values from an existing case study or relevant literature data.
5. Identify the optimum operating conditions and the efficiency for the steam jet ejector based on the derived mathematical model.
6. Understanding the usage of Engineering Equation Solver (EES).

### **3.2 STUDY PLAN**

The study plan is governing both FYP 1 and FYP 2 of a total of 29 weeks. It will clearly show the desired key milestone of the project. Refer to table 3.1 for the study plan in the following page. A logbook approach has been used to report a weekly progress of the project to keep on track of time and resources.

TABLE 3.1 Study plan for FYP 1 and FYP 2

NO.	Component of Research	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
1	TOPIC ALLOCATION																															
	Selecting topic: Performance analysis of steam Jet Ejector																															
2	LITERATURE REVIEW																															
	What is Jet Ejector																															
	Operating Principle of Jet Ejector																															
	Application of Jet Ejector in Industry																															
	Usage of steam as motive fluid																															
	Regime of ejector operation																															
	Process gas load of ejector																															
	Usage of Multi Stage Ejector																															
	Operating parameters																															
	Formating Objectives & Identifying problem statement																															
2	Defence Proposal																															
	RESULTS																															
3	Identifying Design Parameters																															
	Set Necessary Assumption																															
	Submitting the first draft Interim report																															
	Submitting the second draft Interim report																															
	RESULTS & DISCUSSION																															
	Mathematical Model Formulation																															
	Validating the Mathematical Model and adjust if necessary																															
	Submission of Progress Report																															
4	Parametric study																															
	PROJECT COMPIATION AND PRESENTATION																															
	Technical Paper Submission																															
	Oral Presentation -- SEDEX (TBD)																															
	Submission of Dissertation																															

## 3.3 TOOLS AND SOFTWARES USED

### 3.3.1 Engineering Equation Solver for Macintosh operating software platform

EES or Engineering Equation Solver has been used to provide a solution iteratively for a set of algebraic equations. The software has been used on the Macintosh operating software platform. Thus, there are some variations from that of Windows operating software version in terms of tools and layout.

EES has eased to solve the ejector's relevant equations. Figure 3.2 shows an image captured from the EES software. The software has been used to achieve the objectives of the research.

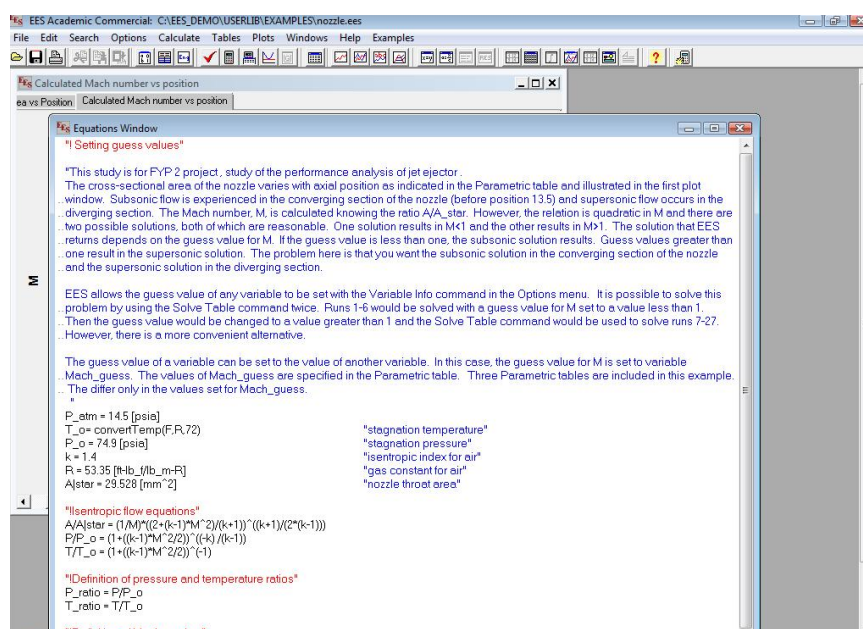


FIGURE 3.2 shows an image from the engineering equation solver (EES)

EES software has been learnt throughout the project. A simplified guideline for using the software has been included in the appendix.

### 3.3.2 iWork 2013 suite: Numbers

Numbers, equivalent software for Microsoft Excel, but for the Macintosh operating software has been used for tabulation of the data and graph plotting.