INSTRUCTIONS FOR WRITING A BITS DISSERTATION

(An Informal guide to BITS Dissertation writing)

BITS ZG629T(Off-Campus)

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE
PILANI, RAJASTHAN, 333031

(MAY 2002)

An Informal Guide to

All Students of BITS, who are doing their Higher Degree

Dissertation Projects in the current semester

Dissertation Projects in this semester culminate in to a very important and final stage of your educational process of BITS. This leads to submission of a professional report of a high quality standard, as required of the BITS Dissertation. A Dissertation report is of a higher standard in it's approach, wider in scope and deeper in the levels of understanding than that of a Thesis report. **As a BITS student, you should take pride in the Dissertation report as well as your work.**

You should take time to read this notice carefully to avoid **unnecessary wastage** of your **hard time** and that of the peer reviewers **in correspondence**. Here are some of the suggestions to reduce this, and also prevent Dissertation report revision. Take a Look at the following sections:

Why all this?
Follow only BITS Standard Format for the Title Pages of Dissertation(S1)
Next page that follows is the certificate. (S2)
Abstract Page (S3)
Expression of gratitude (Acknowledgement), Dedications (S4)
List of symbols, List of Figures & List of Tables (S5)
Index / Table of Contents (S6)
Chapters and their arrangement (Introduction S7)
Results & discussion
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References(S10,S11)
Communications after you submit the Dissertation
Self evaluation or checklist before you send the Dissertation
Some tips, dos and don'ts

Why all this?

We have come to notice the revisions have been necessitated even three times after submission by the due date and even in some cases re-registration into next semester. The resubmission cases account for about 30% of the total number of theses submitted in the current semester. This you can definitely reduce / avoid by carefully going through following instructions contained in this booklet.

The Dissertation will further go through a peer review committee to go through your report in order to oversee the following:

a) Compliance of a BITS standard Dissertation format,
b) Overall impact and contribution made by the Dissertation to the subject/present day knowledge, efforts put in by you to collect data/experiments
c) Technical discussions put forward by him/ or programming exercise done/ experiments done in order to achieve the desired set of goals put forward by him/her
d) How he/she was able to keep to the schedules and evaluation reports.

How the Dissertation should be submitted?   **THE DISSERTATION SHOULD BE SUBMITTED IN A NEATLY TYPED AND BOUND VOLUME ONLY AND IT SHOULD BE COMPLETE IN ALL RESPECTS.**   **Any other form is liable to be rejected / ignored even without notice to you.**

> Taking into account all these parameters, it is likely that **your final grade is liable to be revised** if the Dissertation falls short of any of the guidelines.

Follow only BITS Standard Format for the Title Pages of Dissertation.

Please **do not** have **your own designs of the title and inner cover pages**. Otherwise it is not possible to distinguish between a report and the Dissertation. Please do not cover them by **any other** blank/filled pages. See that the **title of the project** gives an idea of the project covered by your Dissertation and it should be **consistently be same** as **approved by your mentor / BITS**.

See the sample as per the format (S-1).

Next page that follows is the certificate.

Certificate format is to be followed. See that the title of the project is same as given in the title page (s). If not, your Dissertation has **no correlation with the certificate** and makes both the certificate and **your Dissertation invalid**. (Avoid making Certain silly mistakes --**your name misspell, wrong *ID number, name of supervisor or mentor, Name of the organization misspell, Organization stamp giving the incomplete address*.)** See the sample as per the format. (S-2)

Abstract Page

Next is the abstract page. It gives a brief account of the work done by you at your organization in connection with the project taken up by you. Please bind a copy of it in your Dissertation. **Also attach two separate copies for our reference to make a compilation of all the theses in the semester. They can be accessed in BITS library.** See the sample as per the format. (S-3)

Acknowledgement, Dedications

You may like to record the assistance / help offered by people associated with you in making the report. There is no specific format for this. You may format it on your own. No grade or evaluation component is associated with this page. See the sample as per the format. (S-4)

List of symbols, List of Figures & List of Tables

You may want to develop the subject using mathematical/statistical/chemical/ or any other standard notations used in the scientific literature. The list containing the symbols and their meaning should be given in the list of symbols.

You may want to include illustrations, photographs, flow charts and other statistical charts. Carefully Make a list of all those figures in a proper order and give consecutive number. You have to make a reference to the figure in the text of the chapters. The list should have continuous numbering irrespective of the chapters where they appear and the page number. Please make it a point that no figure goes un-referred in your Dissertation.

You may want to include Experimental data, collected data, calculated values and other forms of data in the form of tables. Carefully make a list of all those tables in a proper order and give consecutive number. You have to make a reference to the table in the text of the chapters. The list should have continuous numbering irrespective of the chapters where they appear and the page number. Please make

it a point that no Table goes un-referred in your Dissertation and also without any explanatory note/ comments/observations/conclusive remarks. See the samples as per the format. (S-5)

Index / Table of Contents

Most of the students default here. The list of chapters should be arranged in their natural order of development of your project or how you want to develop the subject. The chapters should be arranged in a sequence. Each page of the Dissertation is to be numbered. Give the starting page number of each chapter in the chapter list. See the sample as per the format. (S-6)

Chapters and their arrangement

Most of the students do not seem to take care this aspect properly. Logically **you know the subject** and what you are expected to do in the semester and how you want to present in a best possible way is in your hands. Hence an equally logical proposition should be that the chapters should be in the following order.

- **Introduction** (your company, explain why the subject is important, what your company is looking forward, How beneficial it is etc) See the samples as per the format. (S-7)
- The **Literature survey / the Background of the problem** (*Literature survey*: How the issue has been tackled in the earlier reports, methods of their analysis, your approach how different or how alike, Methodologies adopted) (***Background***: how the problem arose in the company, is the problem special of your company alone, is it a totally a new development, how a similar problem in the past has been solved? Etc.,).
- **Chapters** containing experiments done, description of setup, Design methods adopted, How data has been collected, observations made, market survey analysis etc., computer software used, its features etc., (It is left to the student how many chapters should be there)
- **Chapter** should be separately made for the **discussion** of the results obtained. This chapter indicates to a reader how the results are interpreted, conclusions drawn at different levels of progress of work.
- **Chapter** should be separately made for the conclusions based on the results obtained. This chapter indicates to a reader net all-round conclusions drawn, suggestions for improvements, limitations/applicability of the work in situations, if it is a software then how it is efficient and in which situation it applicable etc.
- **Format the pages** properly.

How the Pages are to be presented? There is no specific Format for this. It depends upon an established and time tested practice which has been followed in many universities and Technological Institutes. For example:		
1	Running text- font	10/12,
2	Para heading/Table heading	14/16 bold,
3	Sub-Para heading	10/12 bold,
4	Number of lines per page not less than 45/46 depending upon your matter,	
5	Do not format ridiculously low at 5 lines /page without any other table / figure.	
There must be a purpose in doing so.		

See the samples as per the format. (S-7)

Results & discussion

Have a chapter on the results obtained in the observations and calculations or programme outputs. Show what has been the input and what is the output of your studies. Discuss the agreement / variation, Why they have occurred, are there any similar situations in the past to correlate your results, any new development or new finding in the pattern of your results etc.,

Conclusion (Page /Chapter)

It is similar to the results and discussion. High-light important remarks concerning the results and the interpretations --How it has benefited the company, how the results made a difference to previous situations, etc., See the samples as per the format. (S-8)

Appendices

This is a part of the Dissertation where you provide material for additional information on the subject. For example say you referred a company catalogue of equipment specification, or a BIS or BS standard, you may provide pertinent information. Or you want the listing of a computer programme you developed for the purpose. This can be included in this section. You may give number for each appended information in Appendix I, Appendix II etc., Please do not forget to number these pages too. See the samples as per the format. (S-9)

References

This is an important part of the Dissertation helping you and the reviewer as to see how deep you went into subject matter, how to get a similar or contemporary report can be referred, how to compare your results with other research workers in this area etc.,

It is a code **many refereed journals follow**.

It is a good practice to follow an order, which is according to alphabetical order of the authors. This is the best among all.

It is also possible that you publish the subject of the Dissertation in national / international journals. The list of references thus help you educate yourself and also let others to know where to search and what to search more precisely and quickly. See the samples as per the format. (S10, S11). The sample page gives a method how to write the reference in serial order according alphabetical list

COMMUNICATIONS AFTER YOU SUBMIT THE DISSERTATION:

A review committee will evaluate your Dissertation. The Dissertation is reviewed in order that the guide lines provided to you are strictly complied. Any deviation will be notified to you for correction. Cases of Dissertation rejection will arise if:

1. **A student indulges in malpractices,**
2. **A Dissertation is having a matter identical / or similar to that of another student (who is currently on rolls or who has already completed or a student of the same organization, or any ex-student of BITS),**
3. **A Dissertation is a mere copy of text books/ manuals / a report**
4. **The subject matter is too trivial to make it a subject of the Dissertation. (For example if the committee feels that work is not substantial, the work is not enough to cover a period of one full semester).**
5. **A Dissertation topic is too general that a student cannot make a reasonable contribution within the semester.**
6. **A mere compilation of some company reports/ accessible to him and no substantial effort is made by him to discuss, observe, and submit a scholarly work.**
7. **The student could not be contacted with all the possible means of communications as provided by the addresses given by him.**
8. **Mentor and examiner are not properly qualified.**
9. **Registration invalid for the current semester.**

Please note that all the communications will be sent to the **last known email address and postal address given by you in your evaluation forms.** Dissertation revision advises will be sent to these addresses only. Hence it is all the more important that you should inform us your latest address (email /Postal /Telephone / and Fax) in order to help us (to help you). BITS, Pilani will not be responsible for the loss of mail/mail not being delivered/delayed mail in any form. However we will take all the steps to contact you in case any need arises based on these address information **provided by you in the evaluation forms.**

Also remember that your provisional degree certificates/ degree certificates will be sent to these addresses only.

Grade your own Dissertation (Self evaluation) before you submit: Use it as a checklist

Check list\ grade	Excellent	Poor/un-acceptable
Front cover page	BITS Format	Company format
Inner cover page	BITS Format	Company format
Certificate	BITS Format	Company format
Acknowledgement	NA	NA
Abstract	BITS Format	No signatures
Index or Table of contents	BITS Format All page nos given	No page numbers
List of symbol/notations	BITS Format	No list /numbers given
List of figures/photos	BITS Format	No list/numbers given
List of Tables	BITS Format	No tables/numbers given
Chapter 1 (introduction)	BITS Format	No introduction/abrupt beginning
Chapter 2 --- etc	BITS Format	No chapters/freestyle
Chapter x Discussion	BITS Format	No discussion chapter
Chapter x+1 Conclusions	BITS Format	No conclusion
References	BITS Format	Title of book only
Appendices 1,2,3 etc	BITS Format	Every thing jumbled in main Dissertation

WHAT A DISSERTATION IS NOT?
Please remember that a Dissertation **is not** any of the following:
A compilation of Power Point Presentations of a seminar
A text book or a Manual
A Day's report, nor a report of what you are doing in the organization
Company's Marketing report or
Company's Quality Control records
A compilation of Company's drawings
A set of compilation of quotations for a contract

WHAT A DISSERTATION IS?
It is record of student's scholarly work during the semester on a specific goal oriented project.
It could be a software oriented project in order to increase the efficiency and speedy recovery of information in your organization
It could be a design report of a mould / equipment/ special tooling required in the specific unit where the student is working with employer's permission
It could be the study of an implementation policy to achieve cost reduction / zero defects / improvements in employee performance (eg TPM in moulding shop, Quality circles and group efforts)
It could be a detailed analysis of performance of a Machine, tooling, breakdown, how to minimize by substitution of new materials, cost effectiveness
It could be a report of an installation and commissioning of an equipment / software / results achieved, How the entire action has been planned, what are the specific situations involved particular to the site of installation, customer specifications vis-à-vis the specifications of equipment installed, lead times involved cost benefits accrued to the customer etc.,

Some tips, dos and don'ts
1. A Dissertation is not a compilation of Power Point Presentations. Please bear it in mind that they will not be accepted even without any notice to you. They can run the RISK OF BEING IGNORED. They may be impressive for a seminar, but not for a Dissertation. They also contribute to wasting paper with large number of pages with little information how the **subject has been chosen, how analyzed, how experiments were conducted, etc.,**
2. Please remember that you are not writing a Textbook or a Manual. Please confine to your subject. Choose the subject of your Dissertation specific to your assignment. Usually it should be the work carried out at your organization / or at other place on behalf of your **parent company.**
3. Do have a comprehensive plan for your Dissertation. It is not a day's report. Write each chapter **and review entirely and examine the continuity of subject to the next chapter and a logical conclusion**
4. Do not reproduce the pages of a textbook. A reference number should be indicated if it calls for the discussion. Simply put, Do not follow a beaten track which is already available in **standard literature and textbooks**
5. Comparison of your data with other previous records (in a similar situation or in contrast) is **encouraged.**
6. Do not generalize your Dissertation title (For example do not choose titles like Total Quality Management, Six Sigma, Operational methods, Finite Element analysis, Environmental pollution, or catchy But un-understandable titles like ...KKL-SIP-ESFD-MACRO even if it is **justified and meaningful from your angle.)**
7. Instead For example you may choose titles like: Paint-shop quality management in FORD India / Finite Element analysis of a leaf spring, Development of an inventory **management software based on MS Access etc.**
8. Do not simply attach tables to increase the bulk of your Dissertation. Each table has to be discussed thoroughly and interpreted. Neither examiner / nor a reviewer are going to do it. It is your work and you have to explain in detail. Many students attach a vast number of data obtained from their company and that without any reference to it in the discussion in the corresponding chapters. This may add impressive bulk of the Dissertation but of no value. Please do not misunderstand that table / data are unnecessary. They are essential. Provide a **basis and means to understand what you are trying to convey through the tables.**

The following pages S1 to S11 contain samples of some Dissertation pages for guidance and for illustration only. The Titles of a Dissertation, names of persons indicated are all fictitious and may be that the coincidence of their names in an organization is only incidental and it is not aimed at any individual/organisation in making the references.

QC PROBLEM SOLUTION IN

CLUTCH FACINGS & BRAKELININGS

BITS ZG629T: Dissertation

By

V.Sivakumar
(**1999 HZ79507**)

Work Carried at
FORD INDIA LIMITED, CHENNAI

Dissertation Submitted in partial fulfillment of the requirement of
M.S. (Manufacturing Management)

Under the Supervision of
Dr. B.Ramanathan
STA Engineer, Ford India Ltd
Chegalpattu

**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE
PILANI, RAJASTHAN-333031
MAY 2000**

*(This format should be used **for outer and inner cover pages**)*

S2

CERTIFICATE

This is to certify that the dissertation entitled, "QC PROBLEM SOLUTION IN CLUTCH FACINGS & BRAKELININGS" Submitted by V.Sivakumar(1999 HZ79507)in the partial fulfillment of the requirements of BITS ZG629T Dissertation, embodies the work done by him under my supervision.

Signature of the supervisor

_Sd…_
Dr. B.Ramanathan
Date:08/05/2002   _STA Engineer,_
Ford India Ltd
Via SP Koil Post, Marimalai nagar,Chegalpattu

S3

ABSTRACT

Dissertation Title : QC PROBLEM SOLUTION IN CLUTCH FACINGS & BRAKELININGS.

Supervisor : Dr B Ramanathan

Name of student : V.Sivakumar

Semester : Second

ID No. : 1999 HZ79507

This Dissertation work gives an account of the Quality control aspects of the friction materials that are useful for applications in clutch facing and brake linings

Sample analyses, Experiments were done in the moulding department. Defects were analyzed and ranked according to their priorities such as under fill, cracks, warpage, damage and others. Reasons or causes were found out by drawing fish bone diagram. Major steps in the moulding process were verified. Experiments were done to observe the process variables. The process variables having significant changes i.e. temperature of curing and length of curing time Moulding pressure, holding time on the hardness and state of complete cure (measuring unreacted species by acetone extraction test).

Improved the conditions of moulding frozen the process parameters – such as the Moulding pressure, Temperature, pressure-holding time, number of vents. They have been standardized. This strategy has reduced the defects to an extent of 40 %. Further reduction strategy to reduce the defects has been planned.

The Dissertation describes the above work in detail.

Signature of Student   Signature of the supervisor

Akhilesh Kumar Shandilya   Dr B Ramanathan.
                                                                  STA Engineer, Ford India Ltd
Date:08/05/2000   Chengalpattu

(*The abstract should be submitted **in triplicate. One** should be **bound with the Dissertation** and the other two should be enclosed with the evaluation report)*

<u>ACKNOWLEDGEMENT</u>

I take this opportunity to express my profound gratitude and deep regards to my guide *Dr. B.Ramanathan STA Engineer, Ford India Ltd, Chegalpattu* for his exemplary guidance, monitoring and constant encouragement throughout the course of this Dissertation work. The blessing, help and guidance given by them time to time shall carry me a long way in journey of life on which I am about to embark.

Sincere appreciation is extended to Shri I.V.Singh and Shri N.N.Sharma Ford India Ltd for his immense help during the course of this work. In those moment when things used to turn dark his presence had a soothing effect.

I am grateful to Shri Durai prabhakaran Lecturer- mechanical Engineering Department, Anna University, for providing me with the timely help in search of the references for this Dissertation.

I record with appreciation the help rendered by Shri Tulsiram Sharma, Robotics Lab instructor, for this work.

My several well-wishers helped me directly or indirectly; I virtually fall short of words to express my gratefulness to them. Therefore I am leaving this acknowledgement incomplete……….in their reminiscence.

V.Sivakumar

LIST OF SYMBOLS & ABBREVIATIONS USED

A:	cross sectional area of beam
b:	width of beam
C:	damping coefficient
D:	electric displacement
d:	depth of beam
d_{ij}:	piezoelectric moduli
E:	modulus of elasticity
f:	force
G:	modulus of rigidity
H(x):	heaviside step function
h:	half of depth
I:	moment of inertia
K:	stiffness matrix
L:	length of beam
l:	one element length
m:	moment
n:	unit vector
q(t):	time dependence of the load
R_f:	resistance
t:	thickness of PZT
u:	displacement or deflection in beam
V:	voltage applied on PZT
A_n:	coefficient of model series
δ:	derivative for step function
ε:	strain
ε_a:	strain in PZT actuator
ε_p:	piezoelectric strain
θ:	slope
λ_n:	eigenvalue
ξ:	damping ratio
ρ:	density
σ:	tensile strength
$\varphi_n(x)$:	modes
ω_n:	natural frequency
w(x):	transverse displacement
ω_d:	damping frenquency

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Ch No.   Title   Page No

CHAPTER 1
Introduction

In all the transportation (or automobile) vehicles, the clutch and brake systems are very important and critical components. The results can be disastrous if the clutch or brake systems fail.

A brake system consists of a braking mechanism, and its actuating system connected to foot/ brake pedal (through a slack adjuster) near the driver's seat. The braking mechanism consists of a brake drum, brake pads / brake shoes, a 'S'cam , and an air brake chamber to actuate the 'S'cam. The 'S' cam pushes the brake pads such that the brake shoes press against the drum to bring the vehicle to the state of rest.

The clutch is a form of mechanical coupling which enables the transmission of power between the driver and driven shafts aligned along the same axis while former shaft is continuously rotating and the other is in a state of rest or rotating at a lower speeds. Usually clutch is actuated to bring about a change of the speed in the driven shaft.

The Brake pads / clutch facings have one thing in common. That is the friction material which provides frictional surface to provide enough frictional force required to transmit the power either to brake the vehicle (former)or to accelerate the vehicle as clutch.

The brake pads /Clutch facings are made of friction material to provide a positive power transmission and the material should withstand sufficient wear and tear due to forces of friction. The Brake pads or clutch are moulded using a specially formulated phenolic moulding compound to provide a very high coefficient of friction. Usually these materials are used in the light duty vehicles while woven materials are used in moulding heavy-duty facings or pads.

Woven materials provide high strength and stiffness which are present in heavy duty vehicles. Phenolic resin is appropriately selected depending upon the requirements of moulding conditions and product demands. Phenolic resins are very versatile thermosetting resin systems for high temperature service conditions such as braking systems or clutch systems.

Since the resin is a thermosetting one, its cure (further information provided in Appendix I) has to be accomplished only at elevated temperature and pressure conditions. This requires a curing pressure and temperature cycle that is possible in Hydraulic presses which can provide pressures in the range of 50 t0 100 Kg / cm^2 and a temperature range of operation around $150^0 - 250^0$ C.

CHAPTER 7
Conclusions

In this Dissertation an effort is made to understand the functions of friction-materials and to minimize the manufacturing defects. Experimental work indicates that the manufacturing defects account about 40% of the defective parts produced. (From table - 5.1) (almost to an extent of 1/2).

Planned experiments point out that optimizing the Compression moulding process - and its variables can prevent the defects. Studies conducted reveal that moulding pressure, its holding time, and moulding temperature have the significant effect to produce defect-free samples. Production has been optimized to implement the best combination of the process variables to give defect-free or aiming at 0% defect rates during moulding.

Optimization of other non-process parameters also has to be taken up for producing ZERO defect products so that rejection can be totally minimized.

Appendix I
Friction materials- Phenolic moulding compounds

Phenolic resins were the earliest synthetic polymers developed and have useful mechanical and physical properties. The first commercial development of phenolic resins was by Leo Baekeland in 1907 (Bakelite). They are formed by the reaction of phenol with formaldehyde. There are two classes of phenolic resins, Novolacs and Resoles.

Novolacs

An acid catalyzed reaction of phenol and formaldehyde in a ratio greater than one results in the formation of a novolac resin. Novolac resins are typically eight to ten units in size. They are a thermoplastic, thus requiring the addition of a crosslinking agent to form a three-dimensional rigid polymer network.

Resoles

Reaction of phenol and formaldehyde, in a ratio less than one, under basic conditions, results in the formation of a resole resin. Resole resins are thermoset polymers, typically one to five units in size.

Polymers in Industrial Compositions

The industrial partners in this project, Comalco Aluminium Ltd., have closely related interests in the development and behaviour of phenolic resins. Phenolic resins are a component of the composite materials used in the containment of molten metals in the production of aluminium and steel. The Polymer Science Group is pioneering new advances in the study of phenolic resins. The chemistry of the crosslinking and carbonization behaviour of these complex polymer systems is being investigated by various advanced analytical techniques on carefully designed model systems. The increased use of phenolic resins in industry has meant that composite materials with improved properties are highly desirable. Work within the Polymer Science Group has examined the effect of the addition of thermally stable polymers, eg. polyimide systems, to improve the thermo- and chemical resistance, and mechanical properties of the composites. The underlying aim of this project is to develop an understanding of the relationships between the chemical structure, chemical reactions in the processing of polymer resins, the processing parameters and the properties of the final composite products and to apply this knowledge to industrial applications.

Application	Feature	Grade
Heat Resistance Brake Lining	Cream Powder form, Melting Point=75° - 85°	TPF/H/1111
Compounding of Nitrile Rubber	Light Brown Powder form, Melting Point=75° - 85°	TCF/B/1131
Brake Lining	Light Brown Powder form, Melting Point=75° - 85°	TCF/B/1132
Rice Rollers	Light Brown Powder form, Melting Point=75° - 85°	TPF/R/1911

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