HANDBOOK FOR GRADUATE STUDENTS

IN PHYSICS AND ASTRONOMY

Prepared by

The Department of Physics & Astronomy
Gallalee Hall
The University of Alabama
Spring, 1990

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I. SUMMARY OF GRADUATE DEGREES OFFERED IN THE DEPARTMENT OF PHYSICS AND ASTRONOMY

The Department offers both the Ph.D. degree in physics and the M.S. degree in physics. The M.S. degree includes both the thesis option (Plan I) and the non-thesis option (Plan II). Both the Ph.D. and M.S. degrees in physics are offered with specializations in astronomy. The departmental requirements for these degrees are outlined in this manual and in the Graduate Catalog. The student is subject to the general rules and regulations of the graduate school as given in the Graduate Catalog as well as the specific rules and regulations of the Department of Physics and Astronomy.

II. ACADEMIC POLICIES AND REQUIREMENTS

A. SCHOLASTIC REQUIREMENTS

According to the Graduate Catalog, a student must maintain a cumulative average of not less than "B" in graduate courses undertaken at The University of Alabama, and at least 75% of these hours must be completed with grades of not less than "B". Courses in which a student has made a grade of "P" or "S" are not considered in evaluations of academic standing. Students who do not meet these requirements are placed on probation. Probationary status must be removed by raising the overall grade point average to "B" or better during the next 12 hours of graduate course work.

B. ENROLLMENT POLICIES FOR GRADUATE TEACHING/RESEARCH ASSISTANTS

The following is a summary of the current graduate school policies regarding course loads for all teaching assistants and research assistants.

Graduate assistants must be full-time graduate students during all periods in which they receive financial assistance from the University or associated agencies. Depending upon their assistantship obligations, the graduate assistant should normally enroll for 6 to 12 hours of graduate course work. The following enrollment limitations are imposed by the graduate school.

TA/RA Award	Min-Max Graduate Enrollment
.25 FTE	9-12 semester hours
.50 FTE	6-9 semester hours
.75 FTE	3-6 semester hours
1.00 FTE	1-3 semester hours

In addition it should be noted that Immigration Regulations limit international students to a maximum of 20 hours per week of employment, including any combinations of on- and off-campus positions.

A fellowship, as a nonservice award, is outside the scope of these policies. Fellows, by the terms of their appointments, are required to undertake full-time graduate study.

Enrollment during the summer is not mandatory for graduate teaching and research assistants.

C. LIMITATIONS ON FINANCIAL SUPPORT

1. Jobs outside the Department

Teaching and research assistants who hold a 0.5 FTE or greater appointment are not allowed to hold additional employment outside the Department, with the exception of tutoring, without special permission from the Department Chairperson. The Department's policy is that time not taken up by assistantship duties should be devoted to course work, research, and other

degree requirements. Since tutoring aids graduate students in learning the fundamentals of their discipline, a maximum of 5 hours of tutoring per week is allowed. Tutoring students for pay in a course to which you are assigned is not allowed.

2. Time limits on financial support

A graduate student who has been awarded a teaching or research assistantship can normally expect to have support continued as long as he/she is making satisfactory progress toward a degree and fulfilling his/her assigned duties in an acceptable manner. A student working toward a M.S. degree will be expected to complete the degree requirements within three years and financial support will not routinely continue beyond that period. Each student working toward the Ph.D. degree will be evaluated periodically to determine if he/she is making satisfactory progress toward the degree.

III. DEGREE REQUIREMENTS FOR THE PH.D.

- A. COURSE REQUIREMENTS
- 1. Physics

A total of 48 hours of formal coursework is required (in addition to 24 hrs of dissertation research).

Physics course requirements:

PH 501 - Classical Mechanics

- PH 531/532 - Electromagnetic Theory

- PH 541/542 - Quantum Mechanics

PH 551 - Atomic and Molecular Physics

PH 561 - Nuclear and Particle Physics

-PH 571 - Thermal Physics

PH 581 - Solid State Physics

PH 641 - Relativistic Quantum Mechanics

PH 671 - Kinetic Theory and Statistical Mechanics

PH 699 - Dissertation Research (a minimum of 24 hrs)

11 con by contact (23/m)

+5 elections (15 hrs)

The completion of any of the above courses (or the equivalent) with a grade of B or better prior to enrolling as a graduate student in this department will constitute fulfillment of the requirement for that course.

Other courses required: Fifteen hours of additional graduate level courses are required in order to meet the 48 hour minimum for formal coursework (in addition to Dissertation Research). Twelve of these hours may be taken outside the Department. Some approved mathematics courses are listed below.

MA 501/502 - Numerical Analysis I & II

MA 503 - Numerical Linear Algebra

MA 513 - Numerical Methods for Engineering Applications MA 5275- Mathematical Methods of Physics

MA 540 - Introduction to Applied Mathematics

MA 541 - Boundary Value Problems
MA 542 - Integral Equations and Asymptotics

If the student wishes to use courses not on the above list, these courses must be approved by the Department of Physics and Astronomy.

2. Physics with astronomy specialization

A total of 48 hours of formal coursework is required (in addition to 24 hours of Dissertation Research). Physics course requirement (21 hrs of formal coursework and 24 hrs of research):

a. All of the courses below:

PH 501 - Classical Mechanics

/ PH 531/532 - Electromagnetic Theory

✓ PH 541/542 - Quantum Mechanics

PH 699 - Dissertation Research (24 hrs)

b. and two of the following:

PH 551 - Atomic and Molecular Physics

PH 561 - Nuclear and Particle Physics

PH 571 - Thermal Physics

PH 671 - Kinetic Theory & Statistical Mechanics

Astronomy course requirement (15 hrs from the following list, with at least one at the 600 level):

AY 401/501 - Celestial Mechanics & Astrodynamics

AY 421/521 - Theoretical Astrophysics

AY 433/533 - Observational Techniques

AY 550 - Stars and Stellar Evolution

AY 570 - Galaxy and Interstellar Medium

AY 620 - Extragalactic Astronomy

AY 640 - Radiation Processes in Astrophysics

AY 650 - Astronomy Special Topics (only 3 of 15 hrs required)

AY 660 - Astrophysical Plasmas & Magnetodynamics

The completion of any of the above courses (or the equivalent) with a grade of B or better prior to enrolling as a graduate student in this department will constitute fulfillment of the requirement for that course.

Except for the above coursework in physics and astronomy, all other formal requirements for the Ph.D. in physics and the Ph.D. in physics with specialization in astronomy are the same.

B. COLLOQUIA AND SEMINARS

Each Ph.D. student must present a colloquium based on his or her research during the last semester of residence. Research physicists and astronomers are commonly called upon to give oral presentations of their research work to others. It is important to obtain this experience before receiving the Ph.D.

Likewise, the Department believes that attending departmental colloquia is also an important part of a graduate student's education. All full-time degree students in any of our Ph.D. or M.S. programs are required to attend a minimum of 2/3 of regular departmental colloquia (usually given Wednesday afternoon). These colloquia are designed to be of general interest and will serve the purpose of broadening the student's

knowledge of physics and astronomy. Failure to satisfy the colloquium requirements will lead to an automatic review of the student's standing and may result in his/her being dropped from the Ph.D. program. Various research groups may also require their students to attend more specialized seminars in their research.

C. FOREIGN LANGUAGE REQUIREMENT

Prior to being admitted to candidacy for the Ph.D. in physics, a graduate student must satisfy the Department of Physics and Astronomy's language/research skill requirement.

There are two options: (1) one foreign language (German, French, Russian, or Japanese), or (2) computer science.

The language requirement can be satisfied by passing the language profiency examinations offered by the language departments mentioned above or in the case of French and German languages by successfully completing the proficiency courses offered by these departments. Further information about frequency of exams, exam dates, etc. can be obtained by contacting the appropriate language department. English and/or a student's native language are not valid for fulfillment of the language requirement.

The computer science requirement can be satisfied by one of the following methods:

(1) Completion of an appropriate project approved by the Computer Science Department. The Computer Science Department normally allows a designated faculty member in the Department of Physics and Astronomy to assign and grade this project.

(2) Completion of CS 513 (6 hrs) with a grade of B or better.

D. QUALIFYING AND PRELIMINARY EXAMINATIONS

- 1. There shall be two separate exams which a prospective Ph.D. candidate must pass. The first of these will be given early in the student's career and will cover primarily advanced undergraduate physics; the second exam will be given before the dissertation research is begun, and will be more closely related to the student's research area. The first exam is the Qualifying Exam, and is a requirement for entering the Ph.D. program. The second exam is the Preliminary Exam; passage of this exam formally admits one to candidacy for the Ph.D.
- 2. A student entering with a bachelor's degree must attempt the Qualifying Exam by the end of his or her third semester here, and must pass it by the end of the fourth semester. Failure to pass the exam by this date means the student will not be allowed to pursue the Ph.D. degree. Students who request transfer credit for at least 12 hours of graduate work at another university and who intend to earn a Ph.D. degree must pass the Qualifying Exam by the end of their first year at U of A. Special cases and appeals require approval of the graduate faculty.
- 3. The Qualifying Exam shall consist of a written exam and an oral. The written exam will be given twice each year, near the beginning of fall and spring semesters. The oral will be administered the following week. The written exam will cover classical mechanics, electricity and magnetism, and quantum mechanics (25% each), with the remaining 25% of the test selected from other areas of undergraduate physics (electronics, optics,

thermodynamics, statistical mechanics, relativity and experimental techniques). The exam will be given on successive days, three hours each day, with each session to cover half the exam. The oral exam will last about two hours, and will cover material similar to that on the written exam. Only students passing the written exam will be allowed to take the oral.

Passing scores on the written exam shall be determined as follows:

70% or above: outright pass; the written exam need not be repeated.

60% - 70%: conditional pass; the oral exam committee shall decide whether both parts of the exam have been passed, or both must be repeated.

Below 60%: fail. The oral may not be taken.

The written exam shall be compiled and graded by a committee of at least four faculty members. Both parts of the Qualifying Exam must be passed. Only two attempts at the written exam will be allowed, and the Qualifying Exam must be passed in its entirety before the deadline established in Section 2 (above).

A student passing the Qualifying Exam may go directly into the Ph.D. program upon the recommendation of the qualifying examination committee and departmental approval.

4. The Preliminary Exam shall be an oral exam on the student's area of specialization, as well as the basic areas of graduate-level physics, namely PH 501, 531-532, 541-542. The examining committee shall consist of five members of the Department of Physics and Astronomy chosen by a departmental

committee. If the research advisor is known at that time, he/she will be invited to observe the preliminary exam but will not be a member of the committee. The exam should be taken as early as possible once the student has finished the appropriate graduate coursework, and before commencing actual dissertation research. According to the Graduate Catalog, the foreign language/research skill requirement must be passed before this exam is attempted. A student making normal progress would attempt this exam by his or her 7th semester here. Only two attempts at the Preliminary Exam are permitted.

E. RESEARCH AND DISSERTATION

1. Selecting a research area and a research advisor

The selection of a research area and advisor should be made as soon as possible after the student has passed the Qualifying Examination. The student should first interview several faculty members whose research may be of interest to the student. The faculty members will describe research projects of potential interest to the student. The selection of a research area and a research advisor will then be made by agreement between the student and the advisor. As soon the selection is made, the Departmental chairperson must be notified in writing by both the student and the advisor of the decision. If a student and research advisor mutually agree to end their relationship, the student and advisor must both notify the departmental chairperson in writing of this action. The student must then begin the selection process again.

The Department requires that all students doing research

toward a degree be supervised by a research advisor approved by the Department. The student must keep his/her advisor fully informed of the progress of his/her research. Failure to do so could result in the dissertation not being approved.

2. The dissertation committee

After selection of a research advisor and research area and after passing the preliminary examination, the student, in consultation with his/her advisor and Departmental chairperson, will form a dissertation committee. The committee will consist of five members, including the research advisor as committee chairperson, three other faculty members from the Department of Physics and Astronomy, and one faculty member from another department. Students doing theoretical (experimental) dissertations are advised to have at least one faculty member on the committee who is an experimentalist (theorist). A form to use in selecting the committee is given in the appendix. The student is required to meet with the dissertation committee each semester in order that the committee can help monitor and guide the student's research.

3. Final version of the dissertation

A final version of the dissertation will be given to each of the five members of the Dissertation Committee at least two weeks before the oral defense. The student is expected to be responsible for all aspects of the production of the dissertation, including the preparation, typing, reproduction, dissemination to the committee members, and all costs involved.

4. Oral examination

A final oral examination must be passed after completion of the dissertation. The examination will be primarily on the candidate's research work as embodied in the dissertation, but it may also encompass the complete program for the degree. The examining committee will be the Dissertation Committee previously described.

IV. M.S. DEGREE

A. COLLOQUIA AND SEMINARS

The colloquium attendance requirements for M.S. students is the same as for Ph.D. students (see section III. B). However, M.S. students are not required to present colloquia on their research.

B. PLAN I M.S. IN PHYSICS (THESIS OPTION)

1. Course requirements

A total of 24 hours of formal course work is required (in addition to six hours of research).

Required courses in physics:

PH 501 - Classical Dynamics PH 531/532 - Electromagnetic Theory PH 541/542 - Quantum Mechanics PH 599 - Thesis Research (6 hours)

Other required courses:

Nine hours of additional graduate level coursework which must be approved by the Department is required in order to meet the minimum of 24 hours. Six of these hours may be taken outside the Department. Normally these courses are in mathematics. Some

approved mathematics courses are listed below.

MA 501/502 - Numerical Analysis I & II

MA 503 - Numerical Linear Algebra

MA 513 - Numerical Methods for Engineering Applications

MA 537 - Mathematical Methods of Physics

MA 540 - Introduction to Applied Mathematics

MA 541 - Boundary Value Problems

MA 542 - Integral Equations and Asymptotics

2. Selecting a research area and a research advisor

A student should first interview several faculty members whose research may be of interest to the student. The faculty members will describe research projects of potential interest to the student. The selection of a research area and a research advisor will then be made by agreement between the student and the advisor. As soon the selection is made, the Departmental chairperson should be notified in writing by both the student and the advisor of the decision. The selection should be done during the second semester of graduate study. The departmental chairperson must be notified in writing of any change of research advisor.

3. The thesis committee

After selection of a research advisor and research area, the student, in consultation with his/her advisor and Departmental chairperson, will form a thesis committee. The committee will consist of at least three members, including the research advisor as committee chairperson, one other faculty member from the Department of Physics and Astronomy, and one faculty member from another department. A form to use in selecting the committee is given in the appendix.

4. The final version of the thesis

A final version of the thesis will be given to each of the members of the Dissertation Committee at least two weeks before the oral defense. The student is expected to be responsible for all aspects of the production of the thesis, including the preparation, typing, reproduction, dissemination to the committee members, and all costs involved.

5. Oral defense of the thesis

A final oral examination must be passed after completion of the thesis. The examination will be both a comprehensive examination on the masters degree program as well as an examination of the candidate's research work as embodied in the thesis. The examining committee will be the Thesis Committee previously described. The student may take the oral examination no more than twice.

- C. PLAN I M.S. IN PHYSICS WITH ASTRONOMY SPECIALIZATION (THESIS OPTION)
- 1. Course requirements

A total of 24 hours of formal graduate course work is required (in addition to six hours of thesis research).

Physics course requirement:

PH 501 - Classical Mechanics

PH 531 - Electromagnetic Theory

PH 541 - Quantum Mechanics

PH 599 - Thesis Research (6 hours)

Astronomy course requirement:

At least three of the following:

AY 401/501 - Celestial Mechanics and Astrodynamics

AY 421/521 - Theoretical Astrophysics

AY 433/533 - Observational Techniques

AY 550 - Stars and Stellar Evolution

AY 570 - Galaxy and Interstellar Medium

AY 620 - Extragalactic

Astronomy Other required courses:

Six hours of additional graduate level course work which must be approved by the Department is required. It is strongly suggested that students without appropriate background in mathematics take these courses from the following:

MA 501/502 - Numerical Analysis I & II

MA 503 - Numerical Linear Algebra

MA 513 - Numerical Methods for Engineering Applications

MA 537 - Mathematical Methods of Physics

MA 540 - Introduction to Applied Mathematics

MA 541 - Boundary Value Problems

MA 542 - Integral Equations and Asymptotics

2. Research and thesis

The general rules concerning research and the thesis that apply to the Plan I M.S. in physics also apply to the Plan I M.S. in physics with the astronomy specialization.

D. PLAN II M.S. IN PHYSICS (NON-THESIS OPTION)

1. Course requirements

A total of 30 hours of formal course work is required. The course requirement is the same as for the Plan I M.S. degree except that in place of PH 599 (Thesis Research) the student will take two of the following courses:

PH 551 - Atomic and Molecular Physics

PH 561 - Nuclear and Particle Physics

PH 581 - Solid State Physics

2. Oral examination

A comprehensive oral examination on the degree content of

the Plan II M.S. program must be passed during the last semester of study. The committee will consist of at least three members of the Department to be chosen by the Departmental chairperson in consultation with the student. The student may take the oral examination no more than twice.

- E. PLAN II M.S. IN PHYSICS WITH ASTRONOMY SPECIALIZATION (NON-THESIS OPTION)
- 1. Course requirements

A total of 30 hours of formal graduate course work is required. The course requirements are the same as for the Plan I M.S. in physics with astronomy specialization except that in place of PH 599 (Thesis Research) the student will take PH 532 (Electromagnetic Theory) and PH 542 (Quantum Mechanics).

2. Oral examination

The student must pass an oral examination as described under the Plan II M.S. in physics described in part D.2 above.

APPENDIX

CHECKLIST FOR MONITORING PROGRESS TOWARD THE PH.D. DEGREE

Requirement	<u>When</u>
Qualifying Exam	No later than 2nd or 3rd semester, depending on graduate coursework taken elsewhere.
Foreign language	4th or 5th semester. Must be satisfied before prelim.
Selection of research advisor	During 2nd or 3rd year
Preliminary Exam	During 7th semester
Selection of dissertation committee	After passing preliminary exam. Sample form on p. 22.
Meet with dissertation committee	Once each semester
Application for Admission to Candidacy	No later than the semester or summer term in which requirements are to be completed. Sample form on p. 24.
Application for Advanced Degree	No later than the registration period for the semester or summer term in which the requirements are to be completed. Sample form on p. 25.
Give research seminar	During last semester
Submit dissertation title card	At least 10 weeks before graduation. Sample form on p. 25.
Schedule oral defense	During last semester
Submit dissertation to	At least two weeks before defense

committee

Requirement

Get dissertation approval forms signed by dissertation committee

<u>When</u>

Immediately after passing the defense Sample form on p. 27.

Submit report of recommendation for final degree

To be submitted by Research Advisor to Graduate School following oral defense. Sample form on p. 28.

Submit dissertation to Graduate School

After oral defense and at least 6 weeks before graduation.

CHECKLIST FOR MONITORING PROGRESS TOWARD THE PLAN I M.S. DEGREE

Requirement When

Selection of research During 2nd semester advisor

Selection of thesis During 2nd or 3rd semester. committee Form on p. 22.

Application for Admission After 12 semester hours of graduate to Candidacy credit at the University have been received. Approval must be obtained

no later than the registration period for the semester in which the requirements are to be

completed. Sample form on p. 23.

Application for Advanced No later than the registration period for the semester or summer term in which the requirements

are to be completed. Sample form

on p. 25.

Submit thesis title card At least 6 weeks before graduation.

Sample form on p. 25.

Schedule oral defense During last semester

Submit thesis to committee At least 2 weeks before oral.

Get thesis approval forms Immediately after passing the signed by thesis committee oral exam. Sample form on p. 26.

Submit report of recommendation for final degree

To be submitted by Research Advisor
to Graduate School following oral
exam. Sample form on p. 28.

Submit thesis to Graduate After oral exam and at least School 6 weeks before graduation.

CHECKLIST FOR MONITORING PROGRESS TOWARD THE PLAN II M.S. DEGREE

Requirement

When

Application for Admission to Candidacy

After 12 semester hours of graduate credit at the University have been received. Approval must be obtained no later than the registration period for the semester in which the requirements are to be completed. Sample form on p. 23.

Application for Advanced Degree

No later than the registration period for the semester or summer term in which the requirements are to be completed. Sample form on p. 25.

Schedule oral exam

At least two weeks before graduation

Submit report of recommendation for final degree

To be submitted by chairperson of oral committee following oral exam. Sample form on p. 28.

THE UNIVERSITY OF ALABAMA Department of Physics and Astronomy

MEMORA	NDUM		10		
TO:		Chairperson,	Department of Physics ar	nd Astro	nomy
FROM:		(Please	print clearly)	Gradua	te Student
SUBJEC	T:	PETITION FOR COMMITTEE	APPROVAL OF DISSERTATION	/THESIS	}
DATE:					
i s	NAME	(signature),	Research Advisor, Chair		DATE
-	NAME	(signature)		<u> </u>	DATE
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F	ORM	TO BE COMPLET	ED BY STUDENT ONLY DOWN	TO THIS	LINE
APPROV:	ED B	Y:			
			ch Advisor's signature		Date
		Departmen	t Chairperson's signatur	e	Date

Distrib.: Original to student's file; student; Committee members

(Submit in quadruplicate to department)

APPLICATION FOR ADMISSION TO CANDIDACY FOR THE MASTER'S DEGREE

First Name	Middle Name	Last Name	Student No.
Mailing Address _			Social Security No.
Department	Major	Grad. study begun at U. of	A. Month & Year
Bachelor's degree	received from		Month & Year
	,	passed	
The following unde	ergraduate deficiencie	s have been removed:	
Course Number and	<u>Title</u>	<u> </u>	Grade Semester Hours
Total graduate cre	edit earned at The U.	of A.: semester hrs.	Quality points:
I hereby petition	the Dean of the Gradua	ate School for admission to	candidacy for the degree
of		1	under Plan
Thesis subject, if	f Plan I,		
Signature of Appli	lcant	I	Date
	versity of Alabama. It	12 semester hours of graduate t must be <u>approved</u> at least 2	
Since the above na master's degree, t	amed student has met th	Department or School	n to candidacy for the
recommends that the	nis application be app	Department or School roved.	
		Head of Department	Date
136°.		Dean of School	Date
		Dean of Graduate School	Date
Graduate School Di	stribution:	Adm. & Records _ Dept. or Div	Grad. Ofc Applicant

THE GRADUATE SCHOOL

The University of The Universi	of Alabama	PUBLIC ADMINISTRATION MUSICAL ARTS EDUCATION PHILOSOPHY SOCIAL WORK
Vame	Social Secu	ırity #
Mailing Address	Date	
hereby petition the Graduate Dean to be admitted to candidacy foSocial Welfare.	r the degree of Doctor ofEo	lucationPhilosophy
	Dates of Passing Qualit Written	fying Examinations Oral
Major Subject	2	
First Minor Subject		
Second Minor Subject		
First Foreign Language	Examination Passed	
Second Language or Substitute	Examination Passed	
Dissertation Subject		
I hold the following degrees:		
granted by		19
granted by		
granted by		10
	(Signature of C	Dandidate)
SUPERVISORY COMMITTEE: We, the undersigned, certify that examination for the degree of Doctor ofEducationf tion Subject. We recommend the applicant to the Graduate De	PhilosophySocial Welfare.	or the degree.
1		
Down of	Approved by Graduate Dean:	
Dean of College	Date of Approval	

DISSERTATION / THESIS TITLE CARD

Mr.

	Mrs.,			***********	
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			your diploma. If your name does		records as

	or which you are applying.		Date on which you	expect to complete requir	
			(August,	January, May and Year.)	
According to	my understanding, I now need		semester hours, including the f	ollowing courses I am now	taking:
	COURSE NO.	HOURS	COURSE NO.	HOURS	
	COURSE NO.	HOURS	COURSE NO.	HOURS	
			ll .		
			Me		
Approved Major:			Mr. Mrs.		
Approved Major:					
			Mrs. (1	# 18 ** * * * * * * * * * * * * * * * * *	
			Mrs Miss		
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in partial fulf	illment of the requiremen	nts for the degree of
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-		·
Accepted	d on behalf of the Facult	ty of the Graduate
School by the the	hesis committee:	
		Chairperson
		Department Head
Date		
-		Dean, Graduate School
Date		

Submitted by
in partial fulfillment of the requirements for the degree of
specializing i

Accepted on behalf of the Faculty of the Graduate
School by the dissertation committee:
Chairperson
Department Head
Daha
Date
Dean, Graduate School
Date

GRADUATE SCHOOL

THE UNIVERSITY OF ALABAMA

TUSCALOOSA, ALABAMA

TO THE DEAN OF THE GRADUATE SCHOOL:

We, the undersigned, report that as a committee we have examined
NAME:STUDENT NUMBER:
upon the work done in the subjects assigned, namely: Major
Thesis
and find that h attainments (are such) (are not such) thathe may be
recommended for the degree of
I dissent from the foregoing report.

