FLORIDA ATLANTIC UNIVERSITY™

Graduate Programs—NEW COURSE PROPOSAL

UGPC APPROVAL ________________
UFS APPROVAL ________________
SCNS SUBMITTAL ________________
CONFIRMED ________________
BANNER POSTED ________________
ONLINE ________________
MISC ________________

DEPARTMENT NAME: **MATHEMATICAL SCIENCES**	**COLLEGE OF:** **CHARLES E. SCHMIDT COLLEG E OF SCIENCE**

RECOMMENDED COURSE IDENTIFICATION:

PREFIX ______MAD______ **COURSE NUMBER** ___6307_______ **LAB CODE** (L or C) _____

(*TO OBTAIN A COURSE NUMBER, CONTACT ERUDOLPH@FAU.EDU)*

COMPLETE COURSE TITLE

GRAPH THEORY

EFFECTIVE DATE

(first term course will be offered)

____

CREDITS: **3**	**TEXTBOOK INFORMATION:** **J.A. BONDY AND U.S.R. MURTY, GRAPH THEORY, GRADUATE TEXTS IN MATHEMATICS 244, SPRINGER, 2008.**

GRADING ***(SELECT ONLY ONE GRADING OPTION)***: **REGULAR ___X__** **PASS/FAIL ______** **SATISFACTORY/UNSATISFACTORY ______**

COURSE DESCRIPTION, NO MORE THAN 3 LINES:

A first graduate course in theory and applications of graphs including basic properties; algorithms; matchings; network flows; connectivity; colorings; planarity; vector spaces and polynomials associated with a graph.

PREREQUISITES W/MINIMUM GRADE:* **MAS 4107 LINEAR ALGEBRA 2 (MINIMUM GRADE C) OR MAS 5311 INTRODUCTION TO ABSTRACT ALGEBRA 1 (MINIMUM GRADE C)**	**COREQUISITES:** **NONE**	**OTHER REGISTRATION CONTROLS (MAJOR, COLLEGE, LEVEL):**

PREREQUISITES, COREQUISITES & REGISTRATION CONTROLS SHOWN ABOVE WILL BE ENFORCED FOR ALL COURSE SECTIONS.

****DEFAULT MINIMUM GRADE IS D-.***

MINIMUM QUALIFICATIONS NEEDED TO TEACH THIS COURSE:

PH. D IN MATHEMATICS

Other departments, colleges that might be affected by the new course must be consulted. List entities that have been consulted and attach written comments from each.

Computer Science

Stephen C. Locke, lockes@fau.edu, (561) 297-3350____
Faculty Contact, Email, Complete Phone Number

SIGNATURES **SUPPORTING MATERIALS**

Approved by:	***Date:***	
Department Chair: ______________________	______________	**Syllabus—**must include all details as shown in the UGPC Guidelines.
College Curriculum Chair: ______________________	______________	**Written Consent—**required from all departments affected.
College Dean: ______________________	______________	Go to: *http://graduate.fau.edu/gpc/* to download this form and guidelines to fill out the form.
UGPC Chair: ______________________	______________	
Dean of the Graduate College: ______________________	______________	

Email this form and syllabus to diamond@fau.edu and *eqirjo@fau.edu* one week ***before*** the University Graduate Programs Committee meeting so that materials may be viewed on the UGPC website by committee members prior to the meeting.

From: "Stephen C. Locke" <lockes@fau.edu>
Subject: **Fwd: Graph Theory proposal**
Date: March 15, 2010 1:11:24 PM EDT
To: wkalies@fau.edu
1 Attachment, 38.0 KB

Here is a copy of what I sent.

I received no direct response. However, I did see Marty in the parking lot a day or so after sending and told him I had sent him the information. He seemed positive, but that's hardly evidence.

I could ask him for a response per e-mail, even if it is non-committal.

Stephen

(Syllabus file re-attached, as Eudora was giving me a message about a possible security compromise if I just left the old file attached.)

> Date: Tue, 02 Mar 2010 13:12:51 -0500
> To: marty@cse.fau.edu, "Roy B. Levow" <roy@cse.fau.edu>, Thomas@cse.fau.edu
> From: "Stephen C. Locke" <LockeS@fau.edu>
> Subject: Graph Theory proposal
>
> Marty,
>
> The graph theory course I mentioned to you (tentatively titled "Algorithmic Graph Theory") is temporarily shelved. Our graduate committee decided to just go ahead with the first semester, "Graph Theory"; proposed syllabus attached just in case you're interested. It does have several standard algorithms which almost everyone teaches in the first semester of graph theory.
>
> The course would overlap somewhat with our undergraduate course, but I would expect to be able to go more quickly (since students should have been drilled on proofs already) and thus go a fair bit deeper. I might consider letting in a student who had an undergraduate course in graph theory, hoping that the overlap and the material on basic algorithms will give them a breather so that they have time to work on their proof skills, so that these increase. I'd expect that near the end of the course, students could critically read some of the easier research articles in graph theory.
>
> Stephen

Graph_Theor...oc (38.0 KB)

From: Marty Solomon <solomon@fau.edu>
Subject: **Re: Graph Theory proposal**
Date: March 15, 2010 3:46:24 PM EDT
To: "Stephen C. Locke" <lockes@fau.edu>
Cc: marty@cse.fau.edu, wkalies@fau.edu
Reply-To: Marty Solomon <marty@cse.fau.edu>

Stephen,

It looks good!

I don't know how many of our students have the prerequisites
you require, but I'm sure that some, from time to
time, will have the appropriate background and interests for the
course.

Thanks for running it by me.

Marty
----- Original Message -----
From: Stephen C. Locke <LockeS@fau.edu>
To: marty@cse.fau.edu
Cc: WKalies@fau.edu
Sent: Mon, 15 Mar 2010 13:13:28 -0400 (EDT)
Subject: Graph Theory proposal

Marty,

Did you get a chance to look at the Graph Theory Proposal I sent
you? Our programs committee rep will be putting the course through
committee soon and would like proof of our collegiality.

Stephen

Course Syllabus for Graph Theory

1. **Course title/number, number of credit hours**
   Graph Theory, MAD 6307, 3 credit hours

2. **Course prerequisites**
   a. MAS 4107 Linear Algebra 2 (Minimum Grade C)
   or
   b. MAS 5311 Introduction to Abstract Algebra 1 (Minimum Grade C)

3. **Course logistics**
   a. Term – Spring 2011
   b. Notation if online course – N/A
   c. Class location and time (if classroom-based course) – To be determined

4. **Instructor contact information**
   a. Instructor's name – Stephen C. Locke
   b. Office address – Science & Engineering Bldg, SE43, Room 286
   c. Office hours – To be determined
   d. Contact telephone number – office (561) 297-3350, fax (561) 297-2436
   e. E-mail address – lockes@fau.edu

5. **TA contact information (if applicable)**
   N/A

6. **Course description**
   A first graduate course in theory and applications of graphs including basic properties; algorithms; matchings; network flows; connectivity; colorings; planarity; vector spaces and polynomials associated with a graph.

7. **Course objectives/student learning outcomes**

This is a first graduate course in theory and applications of graphs including basic properties; algorithms; matching's; network flows; connectivity; colorings; planarity; vector spaces and polynomials associated with a graph.

Graph Theory is many things to many people. It is a study of structures and relationships. Most people have seen a graph, even if they did not call it by that name: a flowchart for a computer program; a business hierarchy; an electrical network; ball and stick depictions of molecules; a map of airline flights; family trees; tennis playoff diagrams; road maps.

In this course, we study properties of abstract graphs. We also study procedures for solving problems modeled by graphs: what is the shortest path from A to B; what is the minimum cost for connecting several points; how much can be transported through a system and where are the weak points; what's the best way to pair up a list of people with a list of jobs; when are two structures the same?

After completion of the course, the student should be familiar with basic graph-theoretic terminology and should be proficient at solving exercises of the difficulty typically given to graduate students in graph theory. The student should also be able to produce well-written proofs for such exercises, including presentation and defense of these proofs. The student should be proficient at identifying problems solvable by the algorithms and techniques developed in class, including matching and network flows algorithms, depth-first and breadth-first search, and use of extremality. The student should also be able to follow selected research papers in graph theory.

8. **Course evaluation method**
There will be graded homework assignments accounting for 40% of the student's cumulative performance, a midterm exam, accounting for 30% of the student's cumulative performance, and a final exam that accounts for 30% of the cumulative performance. The overall grade in the course is derived from the cumulative performance according to the following table.

9. **Course grading scale (optional)**

Cumulative Performance	Grade
>94%	A
>90% - 94%	A-
>87% - 90%	B+
>83% - 87%	B
>80% - 83%	B-
>75% - 80%	C+
>65% - 75%	C
>60% - 65%	C-
>57% - 60%	D+
>53% - 57%	D
>50% - 53%	D-
<50%	F

10. **Policy on makeup tests, late work, and incompletes**
If a student cannot attend an exam or hand in a homework project on time due to circumstances beyond their control then the instructor may assign appropriate make-up work. Students will not be penalized for absences due to participation in University-approved activities, including athletic or scholastics teams, musical and theatrical performances, and debate activities. These students will be allowed to make up missed work without any reduction in the student's final course grade. Reasonable accommodation will also be made for students participating in a religious observance. Also, note that grades of Incomplete ("I") are reserved for students who are passing a course but have not completed all the required work because of exceptional circumstances. A grade of "I" will only be given under certain conditions and in accordance with the academic policies and regulations put forward in FAU's University Catalog. The student must show exceptional circumstances why requirements cannot be met. A request for an incomplete grade has to be made in writing with supporting documentation, where appropriate.

11. **Special course requirements (if applicable)**
N/A

12. **Classroom etiquette policy (if applicable)**
University policy on the use of electronic devices states: "In order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular telephones and pagers, are to be disabled in class sessions."

13. **Disability policy statement**
In compliance with the Americans with Disabilities Act (ADA), students who require special accommodation due to a disability to properly execute coursework must register with the Office for Students with Disabilities (OSD) -- in Boca Raton, SU 133 (561-297-3880); in Davie, MOD 1 (954-236-1222); in Jupiter, SR 117 (561-799-8585); or at the Treasure Coast, CO 128 (772-873-3305) – and follow all OSD procedures.

14. Honor Code policy statement

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001 at [http://www.fau.edu/regulations/chapter4/4.001 Honor_Code.pdf](http://www.fau.edu/regulations/chapter4/4.001_Honor_Code.pdf)

15. Required texts/readings

J.A. Bondy and U.S.R. Murty, *Graph Theory*, Graduate Texts in Mathematics 244, Springer, 2008.

16. Supplementary/recommended readings

a. B. Bollobás, *Modern Graph Theory*, Graduate Texts in Mathematics 184, Springer, 1998.
b. D. West, *Introduction to Graph Theory, Second Edition*, Prentice Hall, 2001.
c. C. Godsil and G. Royce. *Algebraic Graph Theory.* Springer GTM 207 New York 2001.
d. J.L. Gross and T.W. Tucker. *Topological Graph Theory*. Wiley-Interscience 1987.

17. Course topical outline

Lecture Schedule

- Basic properties: Material equivalent to Chapters 1 and 2 (sections 2.1 to 2.6) in Bondy and Murty could be assigned to students as readings, with some covered in class to maintain pacing. [ca. 2 weeks]
- Matching algorithms and network flows: Hall's theorem, König-Egervary theorem, Kuhn-Menkres algorithm. {0,1}-flows, extensions to rational flows. Derivation of Hall's theorem, König-Egervary theorem, and four versions of Menger's theorem from {0,1}-flows. Computational complexity of at least one of these algorithms. [ca. 2.5 weeks.]
- Connectivity and cycles: Continuation of results using Menger's theorems. Hamilton cycles. NP-complete problems. Dirac's theorem. Tarjan's DFS block algorithm.[ca. 3 weeks]
- Colorings: Matchings in a bipartite graph yield edge-coloring. Vizing's theorem. Brooks's theorem. [ca. 1.5 weeks.]
- Planarity and embeddings on surfaces: Kurotowski's theorem. Euler's Theorem. Grinberg's Theorem (sometimes called Kozyrev-Grinberg theorem). The 5-color theorem. Heawood's theorem. [ca. 2.5 weeks.]
- Vector spaces associated with a graph: Cycle space. Bond space. Circulations. [ca. 1 week.]
- Polynomials associated with a graph. Chromatic polynomial, Characteristic polynomial and Eigenvalues, Matrix-tree theorem, Flow polynomial, Whitney rank polynomial and Tutte's polynomial. [ca. 2.5 weeks.]
- Other topics of interest might be introduced very briefly during lectures or after completion of a series of lectures on one of the above topics. Matroid polynomials, Knot polynomials, directed graphs, hypergraphs, etc. [ca. 1 week.]