Mathematical Problem Solving

MAT 4937-001 [82670], Fall 2013

Syllabus

Course title/number, number of credit hours
Course Title: Mathematical Problem Solving
Term: Fall, 2013 Classroom location: SE 215 TR5-6:20pm
Is this an online course: Yes ___ or No _x__ Credit hours 3
CRN(optional): 82670 Course number: MAT 4937 001

Course prerequisites or corequisites
Course number: MAC 2312
Pre-requisites Course Title: Calculus with Analytic Geometry 2
Course number: MAD 2104
Prequisites Course Title: Discrete Mathematics
Course Number: MAS 2103
Prerequisites Course Title: Matrix Theory
Permission of the instructor is required:
Yes ___ or No _x__

Instructor contact information
Instructor: Frederick Hoffman Office: SE 212A
Office Hours TR 3:30-4:30pm Office Phone: (561) 297-3345
E-mail Address: hoffman@fau.edu

Course description
This course will focus on some interesting theorems and problems in mathematics. Most of these problems will require very little in the way of background knowledge of mathematics. Some of the questions may involve some geometry, number theory, graphs or group theory. This does not mean that you must have taken a course in any of these areas. In general, you may need to find inventive ways to use mathematics you already know.

Students should enjoy solving mathematical problems and be willing to tackle new problems and learn new techniques. The student should not be afraid to cross boundaries from one mathematical area to another in the solution of one problem. Some ability to program a computer or programmable calculator could be an asset for some problems.

Objectives, Learning Outcome Goals: Upon successful completion of the course the student
Will have been exposed to inquiry-based learning, in particular, the "modified Moore Method"
Will have developed plans of action
Will have practiced critical thinking
Will have developed ethical standards for research
Will have presented their own proofs of mathematical results, in writing, in classroom presentations and discussions and in examinations

The following statement pertains to this section of MAT 4937

This course was developed out of an FAU Curriculum Grant Program, designed to support integrating research and inquiry ideas and activities into course assignments, and engaging students in the process of discovery as part of FAU’s Quality Enhancement Plan (QEP) program: Distinction through Discovery. As part of this course, some of your work samples may be collected to evaluate the effectiveness of the Distinction through Discovery program. For more information about the QEP, please visit http://www.fau.edu/qep/


Some additional notes and/or problems will be distributed by the instructor. These may be in the form of paper copies during class periods or web pages or e-mail communications.

Course Format. Classes will consist of a mixture of

- Brief lectures by the instructor,
- interactive (group) problem-solving by the students,
- individual problem-solving by the students,
- student presentations of solutions,
- constructive student critiques of the work of other students.

The course will be a “modified Moore Method” course, as described, e.g., by Peter Renz, in the August/September 1999 issue of Focus

Problems will be drawn from a variety of sources including, but not limited to, national and international high school competitions, problems sections of journals, and texts.
Grading.
Solutions and presentations of solutions of assigned problems, 20%.
Test 1, 20%, Friday, September 27, 2013. Test 2, 20%, Friday, November 22, 2013.
Final, 40%, Wednesday, December 11, 2013, 10:30 a.m. - 1:00 p.m.

Bonus Points are available for solutions submitted to journals. The purpose of this course is to improve your problem solving skills. If you can demonstrate that you have these skills at a high level, you deserve a good grade. Points vary according to the journal, the difficulty of the problem, and the elegance of the solution.
American Mathematical Monthly. max 25 points per problem,
Mathematics Magazine max 15 points per problem,
PIME Journal max 10 points per problem.
Course instructor reserves the right to modify this scale if warranted.

Grading Scale.
90% → A; 87% → A-; 83% → B+; 80% → B; 77% → B-; 73% → C+; 65% → C; 60% → C-
50% → D; below 50 → F.

All students are expected to keep a journal of solutions. That is, you will take down the solutions presented by the instructor or by the other students, and rewrite these solutions to make them presentable. It is strongly suggested that you start each solution on a new page, and that you copy the question onto the beginning of the page. The instructor may call for these journals at any time during the semester, to make sure that students are keeping up with the work. (It is not a promise that the instructor will call for them.)

Tests will be closed-book, but much of the content will be drawn from what was done in class. Some test questions may be previous-worked questions. Some test questions may expect you to apply what you’ve learned to new problems.

Students will also be expected to communicate their ideas, both written and orally. Finding a solution to a problem is an important step. Convincing others that the solution is valid is another. Elegance of the solution is also desirable, and we will frequently look for a better solution.

Overview. There are several steps that one should use to solve mathematical problems. Many of these ideas apply to problems in other sciences. Obviously, not every problem is amenable to the same approach, but you should keep the steps in mind as you approach a new problem. The following list is similar to one in Larson's book, Problem Solving through Problems, and many of the ideas appear in the texts by Polya and Zeitz:

- Find definitions of any unknown terms.
- Consider known results regarding these terms.
- Do some examples. (Sometimes using a computer.)
- Draw pictures, if applicable.
- Try to find an equivalent problem.
• Modify the problem. See what happens if you leave out a hypothesis, or add a new one.
• Choose effective notation.
• Look for symmetry or parity.
• Divide into cases.
• Try working from conclusion to hypotheses.
• Try contradiction.
• Consider extreme cases.
• Simplify. Generalize. (Sometimes happens accidentally by misreading problem.)

Suggested Bibliography

Books focusing on Problem Solving Techniques:


A Sampling of Source Books for Problems:


Books for more recreational reading:

5. George Gamow, *One Two Three ... Infinity,* Bantam 1971

**Journals**
1. Fibonacci Quarterly
2. MAA American Mathematical Monthly
3. MAA Mathematics Magazine
4. Scientific American (Mathematical Recreations column in older issues).
6. The Π Μ Ε Journal.
7. Regular attendance is expected, including active involvement in all class sessions
8. and professional conduct in class. If announcements are made in class, students are assumed to be aware of the announcements. Students are responsible for arranging to make up work missed because of legitimate class absence, such as illness, family emergencies, military obligation, court-imposed legal obligations, or participation in university-approved activities. It is the student's responsibility to notify the instructor prior to any anticipated absence, and within 24 hours after an unanticipated absence. Makeup tests and exams will be given only under circumstances which coincide with university policy (see link below under attendance). If you miss a test or exam, you must provide a written, verifiable excuse, if possible in advance of the scheduled exam. For unforeseen absences, you must notify the instructor within 24 hours. http://www.fau.edu/academic/registrar/catalog/academics.php#policiesall
9. Incompletes are only given according to University policy.
10.
11. Calculators and other electronics
12.
13. Students may use electronic textbooks during class; no other use of cellphones, tablets or computers is permitted; cellphones must be silenced.
14. Required text
16. Classroom Etiquette
17.
19. Honor Code
20.
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_Code_of_Academic_Integrity.pdf

Students with Disabilities

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) and follow all OSD procedures. 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). OSD website at http://www.osd.fau.edu