SYLLABUS - MATH 2417.HN1 - FALL 2016

• Contact: **V. Ramakrishna, FO 2.408C**, Campus Extension: **6873**; email: **vish@utdallas.edu**

• Classroom and Hours : M & W 5.30-6.45pm SLC 2.203

• **Office Hours: Tuesday 6-7pm & Wednesday 3-4pm and by Appointment.** Students are welcome to use other times to meet me. But to avoid potential conflicts they should send me an email at least 24 hours in advance and attempt to converge on a mutually convenient time.

NB: There will be occasions when I will have to be away in important meetings during the time officially allotted for office hours. In that case, students should make appointments to meet me at other mutually convenient times.

Learning Outcomes:

- Students will be able to apply the method of induction to demonstrate results in calculus.
- Students will understand how to use derivatives to locally linearize a function, optimize a function and to demonstrate inequalities between functions.

- Students will be able to integrate a wide class of functions including trigonometric, rational and algebraic functions.

- **Teaching Assistant:** Mr. Pavel Krawetc. Further contact information and office hours for the TA will be provided during the I problem session.

PROBLEM SESSION: Every student should be registered for the **problems session** Math 2417. HN2, in CB3 1.304, each Tuesday 3-4.50 pm. In particular all quizzes will be conducted only during the problem session.

- **Recommended Use of the Problem Session**: Due to the vast amount of material that I have to cover, I cannot spend all the lecture time on illustrative numerical calculations. *You should use the problem sessions to work out such problems.* **Note that all quizzes, of 30 minutes duration each, will also be held during the problem session.**

- **Additional Problem Session:** I (not the TA) will conduct an additional, but optional, problem session every Friday for approximately an hour in FO 2.404, starting September 2nd, from 5 - 6pm. Though the session is optional, students in the past have found it quite benefi-

cial.

- **Grading Policy:**
  - Quizzes: 15 percent
  - Homeworks: 25 percent
  - 2 Midterms: 20 percent each. Will be held on September 28th (Wed) and November 9th (Wed) - **note, both exams take place during regular lecture session.**
  - Final: 20 percent. Will be held on the time assigned in the *Final Examination Schedule.* Once that schedule is out, I will post details on elearning.

- **Tentative Grading Scale:** Your grade is based on your cumulative performance on quizzes, HWs and examinations. The scale is as follows:
  - ≥ 97: A+ ; $90 - 97 : A$; $87.5 - 90$: A-
  - $83.5 - 87.5$: B+ $80.5 - 83.5 : B$; $77.5 - 83.5$: B-
  - $73.5 - 77.5$: C+; $70.5 - 73.5$: C; $67.5 - 70.5$: C-
  - $63.5 - 67.5$: D+; $60.5 - 63.5$: D; $57.5 - 60.5$- D-
  - < 57.5 - F

- **Quizzes** There will be total of 12 quizzes and the best 10 will be counted towards the grade. They will be held

on the following Tuesdays during the Problem Session you are registered for:

- **Dates for Quizzes**:
- **September:** 6th, 13th, 20th
- **October:** 4th, 11th, 18th, 25th.
- **November:** 1st, 15th, 29th.
- **December:** 1st, 6th.

- **Homeworks:** Weekly HWs will be assigned starting the week of August 29th and they will be due in your problem session the following week. HWs will be posted on elearning and will clearly display the due date. They count towards 25 percent of the grade the HWs and are essential. They not only contain prototype problems for the examinations and quizzes, but also additional topics which are important for the broader understanding of the subject. In general, the HWs will be harder than in class examinations and quizzes. You are encouraged to work in groups, consult me or the TA for hints. However, each of you must write up complete solutions on your own.

- **Other Important Dates:** Please consult the Fall 2015 *Academic Calendar* for first/last dates for various types of withdrawals; official university closings and oher university closings. The final examination schedule is not

up at the point of writing. Once it is available, I will alert you to the final examination date and time.

• **Recommended Textbook** is Calculus, by M. Spivak, W. A. Benjamin 1967 (or later editions). Note the book is only *recommended* Students are encouraged to actively use other books for broadening their horizons!! I will periodically refer you to other texts on related material.

• **Notes:** I will quite frequently give you additional notes. In essence they represent what every lecture is. In particular, the notes will **often supersede** the text, and hence must be read and mastered.. Unfortunately such occurrences cannot be avoided given the breadth of topics to be covered. In such instances, however, I will tell you to what sections in the text the notes correspond to approximately, or for that matter, if they are not covered in the text).

These notes are **also** meant to complement the text. Typically, the notes will also relate the material of this course to other courses that are of interest (such as Differential Equations, Linear Algebra, Physics/Engineering Courses).

• **Deviation from Order in Textbook:** Please be

forewarned that i) not all sections will be covered; and ii) there will be deviations from the logical order presented in the textbook. *Therefore, if you miss classes, the onus is on you to check with me regarding which sections or notes were covered. I will not track you down to keep you up to date.*

- **Syllabus:**

1. Number Systems and mathematical induction with formulae for sums of powers; Binomial coefficients, Fibonnaci numbers, Catalan numbers.
2. Functions: Domains, Ranges, Graphs, Level Sets, Polynomials, Rational Functions, Step Functions, Even and Odd Functions, Characteristic Functions, Matrices and Matrix Products.
3. Limits and Continuity: Computational Techniques, Formal Definition, Algebraic Properties, Continuous functions on closed intervals, Intermediate Value Theorem.
4. Differentiability: Secant Lines, Tangent Lines, Local Linearization, Limit Definition, Derivatives of Polynomials, Chain Rule.
5. Further Differentiability: Higher Order Derivatives, Maxima/Minima, Rolle's Theorem, Lagrange's Mean Value Theorem, Convex Functions, L'Hopital's Rule.

6. Inverse Functions and their Differentiability.
7. A potpourri of functions: trigonometric, exponential, hyperbolic, Bernoulli polynomials, Special functions (time permitting)
8. Integration, Antidifferentiation, Improper Integrals, Fundamental Theorem of Calculus, Functions Defined Via Integrals.
9. Computational Techniques for Integration: Change of Variables Formula, Integration By Parts, Integration of Rational Functions.
10. Sequences, Series, Convergence and Absolute Convergence, Tests for series.

- **More on Grades and the Like:**

  - Each quiz will be worth 30 points. The best 10 of the 11 quizzes will count towards your quiz grade. The total will then be divided by 20 to account for the 15 percent that the quizzes constitute in the final grade for the course.
  - Each HW is worth 100 points. Some problems will be extra credit problems. Students can use these problems to makeup for unsatisfactory performances in other HWs, with the understanding that the total points for HWs is only 25 percent of the grade. You

are fully welcome to seek help in the form of hints, for instance, from me or the TA - please do not limit yourself to our office hours for such things.

- Examinations: Each examination will contain 5 questions (each of which could be divided into one or more parts). The best 4 questions will count towards your grade.
- I will post practice tests and also conduct reviews before each examination.
- It is to be understood that merely writing the answer down will get no credit. The emphasis will be on displaying the method. At all times, in your answer, *the flow of logic and reasoning* must be very clear. In other words, the burden is on you to display on paper your thinking and not on the grader to decipher what you may have meant. In particular, this entails writing in complete sentences or using the permitted logical connectives.
- **Calculators**: No electronic devices of any kind will be permitted for any exam or quiz. All exams and quizzes will be be closed book. At any rate, the typical problem will not involve heavy calculations but will rather test the basic principles underlying the topics covered.

- **Type of problems to be expected:** Whilst there will be the odd few drill problems (i.e., the ones involving routine insertion of numerical values into some formula), the bulk of the questions will test your conceptual understanding of the subject.
- Cheating will not be tolerated. Students are expected to inform the lecturer of any suspected violations of the honor code.

Makeup Policy for Math 2417. HN1:

• **Makeup Policy** (Also posted as a separate document): In general makeups will be allowed **only** if there is a valid reason which is supported by official documentation. Examples of valid documentation are i) Doctors' notes; ii) Letter from employer (in case there is required work related travel, which conflicts with the day of an examination); iii) Travel documents (e.g., when a dire family related emergency travel conflicts with the day of an examination). Furthermore, *the onus* is on the student to intimate to me in a timely fashion (in particular, before the scheduled test), the possibility of having to miss the scheduled assignment.

• *However*, note that all such documentations will be rendered *null and void*, if there is any evidence that the student was, in fact, in a position to take the examination/quiz/HW at the originally scheduled time. Thus, for instance, a doctor's note advising rest on the date of an examination for this course will be considered null and void, if the student was known to have taken an examination for a different course on the same day.

• The makeup quiz/HW/examination must be taken at the earliest opportunity convenient to *the instructor*, once the reason for missing the scheduled examination

is no longer in force.

• The makeup quiz/HW/examination **cannot** be guaranteed to be at the same level of difficulty as the originally examination which was missed.

• Failure to observe any of the above procedures will result in a score of **zero** being assigned for the quiz,HW, examination in question.

• **Aims of the Course:** The aim of the course is to emphasize those aspects of the theory of functions of a single real variables which are extremely important in physics, engineering (electrical and mechanical), economics and of course, mathematics itself. The emphasis will be on the qualitative, quantitative and occassionally the philosophical aspects of those parts of the course which are ubiquitious in these applications. For example, the role of differentiability in approximating a function via a linear function is perhaps the single most important utility of calculus, and I will dwell on this in length (going beyond calculational methods).

• **Pace and Style of the Course:** There are two overwhelming factors which will decide the pace and style of the regular lecture hours:

1. There is a tremendous amount of material to be cov-

ered. It is not easy to neglect any chapter of the text.

2. The major use of mathematics in general, and this course in particular, is not to produce meaningless numbers out of arid formulae. Rather the use is to observe patterns, extract the essence from these patterns, deduce logical conclusions from this essence and then, most importantly, interpret these conclusions. The last aspect is why most of mathematics has yet to be done and is also precisely why mathematics plays such an important role in human affairs. In other words, the path to the formula and then the numbers is at least as interesting, and often more important than the formula itself.

Keeping in mind these two factors the style of the lectures will be as follows:

1. Most of the lecture will consist of motivating the material via i) the naturality of the concept to be studied on basis of prior experience; ii) plausibility arguments for the proposed formulae and properties; iii) constructive proofs where this is possible; and iv) Relating various parts of the syllabus to one another (thus, frequently my lectures will also mention, in brief, material **that will be covered in detail later**).

2. Most concepts will be illustrated via a calculational

example. But I will not spend excessive time on them. Calculations are important to get a good feel for the subject, and the HWs are an important way to hone one's skills in this regard.

Campus Carry: Please familiarize yourself with this important change to campus matters. More details may be found (and should be read) at the following site:

https://www.utdallas.edu/campuscarry/.

The University's concealed handgun policy is posted there.

MATH 2417. HN1 - REQUIRED SIGNED STATEMENT
FALL 2016
V. Ramakrishna

• Please read the following statement. Sign your name, print your full name, but leave no other marks of identification.

I have received the handout regarding grading policies, aims, pace and style of the course, and the syllabus for the course. This handout was fully explained in the first lecture. I have also read it and understood it. I also received the *Policy on Makeups*.

SIGNATURE:

PRINTED FULL NAME:

MAJOR: