



# Michigan Tech

## UN5390: Scientific Computing I

Fall 2016

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### Course and Instructor Information

Course # : UN5390 (cross-listed as BE5390, EE5390 and MA5390)  
Course name : Scientific Computing I  
Location : Fisher Hall 330  
Lecture days and time : TR, 8:05 am – 9:20 am

Instructor : Dr. Gowtham  
Contact information : EERC B39 · [g@mtu.edu](mailto:g@mtu.edu) · (906) 487-4096  
Office hours : By appointment

### Course Objectives

1. To gain an exposure to Linux command line, shell scripting, Git revision control system, and free/open source tools and utilities to design and develop computational workflows
2. To acquire/enhance good programming and communication etiquette with an emphasis on readability and clarity of written code
3. To translate science and engineering problems into computer programs, learn compilation, debugging and profiling techniques, and understand various sources of error
4. To learn parallel programming techniques using OpenMP, and data visualization
5. To learn about the use of hardware accelerators (time permitting)

## Suggested References

There is no prescribed/required text book for this course. Listed below are useful references and are usually available from the university library. Much of the material deemed necessary by the instructor will be made available to you.

1. [Numerical Recipes – The Art of Scientific Computing](#)  
W. Press, S. Teukolsky, W. Vetterling, B. Flannery; 978-0-521-88068-8
2. [The Art of Computer Programming \(vol. 1-4A\)](#)  
D. Knuth; 978-0-321-75104-1
3. [The Practice of Programming](#)  
B. Kernighan, R. Pike; 978-0-201-61586-9
4. [The Science of Debugging](#)  
M. Telles, Y. Hsieh; 978-1-57610-917-5
5. [Linux Command Line and Shell Scripting Bible](#)  
R. Blum, C. Bresnahan; 978-1-118-00442-5
6. Language and/or domain-specific literature  
Check with your advisor(s), mentor(s) and/or friend(s)

## Grading Scheme

Final grade = 50% Assignments + 25% Project + 25% Active Participation

A (4.00): 93% and above	AB (3.50): 88% – 92.99%
B (3.00): 82% – 87.99%	BC (2.50): 76% – 81.99%
C (2.00): 70% – 75.99%	CD (1.50): 65% – 69.99%
D (1.00): 60% – 64.99%	F (0.00): 59.99% and below

Active participation (AP) is measured by attendance, how well you come prepared, your ability to lead the problem solving process in front of the class, etc. There is no *curving*, i.e., the grade you get is the grade you earned. Anything less than a B for the final grade could jeopardize your enrollment, funding and/or immigration status. Demonstrating preparation, consistency and quality in the work you do, a willingness to help others in a kind and graceful manner, and *I will do more than what is asked* behavior are critical to earn a reference letter for graduate school/internship/fellowship/job applications.

## General Guidelines

1. Show up on time. If the door is closed, stay out and do not bother coming in
2. Show up prepared, and in a presentable and professional manner. You might be randomly picked on any given day to lead a problem-solving process in front of the class
3. No drinking, eating, facebooking, gaming, instagramming, sleeping, snapchatting, texting, tweeting, etc. during class. Cell phones must be in silent mode as well
4. Course material and assignments will be distributed, and assignments and project work must be submitted via GitHub. You may turn in partially completed assignments, without the fear of penalty even if you believe the solution is incorrect, to show timely and continuous work. You may incorporate my suggestions, if any, into your assignment and turn it in for grading. Late submissions will not be accepted.

There are no restrictions on programming languages. You can use any language, more than one if necessary, for this course. The choice of languages should be guided by their applicability to your research endeavors, and their potential for parallelization. You are responsible for learning the language including its features and caveats.

It is expected that you will work on the assignment consistently from the day it's handed out. If you have any questions, concerns and/or need further information, you must get in touch with the instructor at least 48 hours before it's due. Use an method [in person (on/off campus), email (with UN5390: or BE5390: or EE5390: or MA5390: in the subject field), phone call, etc.] that works for you to do so.

Assignments and project reports must be typeset in L<sup>A</sup>T<sub>E</sub>X using the provided template. Microsoft Word, Notepad, handwritten notes, etc. will not be accepted. There is no need to explicitly include the code in the .tex document.

It is acceptable (and often highly encouraged) to seek help from your classmates and/or others but any such help must be clearly and appropriately cited in the assignment. If you helped someone, you must include that information as well. Absence of proper citation and/or inability to explain your work will mean that someone else authored it. This, in turn, means that you will get no credit for the problem and the incident will be treated as a case of academic dishonesty.

Submissions must be thoroughly spell-checked for typographical and/or grammatical mistakes. If the submissions contain such mistakes or be otherwise deemed difficult to understand, you will be required to work with the *Michigan Tech Multiliteracies Center*

5. Academic policies: <http://www.mtu.edu/deanofstudents/academic-policies/>

## Tentative Timeline

### Week 01 – 02

A Brief History of Computing  
Compliance and Security  
Git, GitHub and UN5390  
Computational Workflow  
Programming Etiquette  
Watch [Silicon Valley](#) (PBS; not Showtime)  
Research Marketing I (AP 2%)  
Library Instruction  
Assignment #01 (5%)

### Week 03 – No Class

Instructor at [CASC](#) in Alexandria, VA  
Attend [Webinars\(s\)](#); catch up on life

### Week 04 – 05

Review of Assignment #02  
Statistics, Numbers and Errors  
Journal of Failed Experiments  
Program Compilation  
Debugging and Profiling Programs  
Integrated Development Environment  
PB&J Sandwich (AP 2%)  
Assignment #04 (10%)

### Week 06 – 09

Review of Assignment #04  
Numerical Results  
Numerical Methods – Finding Roots  
Numerical Methods – Differential Equations  
Research Marketing II (AP 2%)  
Assignment #06 (15%)  
Review of Assignment #06  
Numerical Methods – Integration  
Numerical Methods – Matrices  
Assignment #09 (20%)

### Week 09 – No Class

Instructor at [NSF](#) in Arlington, VA  
Attend [Webinars\(s\)](#); catch up on life

### Week 10 – 11

Beyond Desktop Computing  
Parallel Computing and Programming  
OpenMP  
OpenMP Examples  
Term Project (Starting Week #10; 25%)

### Week 12 – No Class

Instructor at [SC16](#) in Salt Lake City, UT  
Attend [Webinar\(s\)](#); catch up on life

### Thanksgiving Break

### Week 13 – 14

Review of Assignment #09  
OpenMP Examples (Continued)  
Managing and Visualizing Data  
Hardware Accelerators (Time permitting)  
Research Marketing III (AP 2%)  
Semester Summary

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Remaining active participation credit is reserved for attendance (6%), leading a timed problem solving process in front of the class when chosen randomly (2%), and doing a little more (9%).

A weekly meeting with your research advisor and a weekly status report of research project (worth 1% each) are required during weeks 10 – 14. Your research advisor decides 20% of the grade by 5 pm of the finals week.