UTD	**Course** **BIOL 5460** Quantitative Biology
	Professors Michael Q. Zhang Zhenyu Xuan
	Term Fall 2016
	Meetings Tuesday and Thursday 8:00-9:45am, FO3.616

Professors' Contact Information

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General Course Information

Pre-requisites, Co-requisites, & other restrictions	Undergraduate preparation in molecular and cell biology or related field, including a minimum of two semesters of calculus.
Course Description	This is a core graduate course that is designed and structured to provide biology students with introductory quantitative knowledge of the principles and applications of various aspects of classical and modern biology. The course covers aspects of quantitative biology that are very widely used in contemporary biological science research. Topics include fundamental statistics concepts, such as probability, mean and variance, confidence interval, hypothesis testing and linear regression, together with their application in analysis of biological data from microarray and genomics. The course is tailored to accommodate the ever changing applications of these principles in modern biochemistry, molecular and computational biology research. Students are provided with necessary tools to gain quantitative understanding of these areas.
Learning Outcomes	Students will be able to: 1. Appreciate the fundamental mathematical and statistical principles behind modern quantitative biology. 2. Obtain a working knowledge of applying these principles in their own research and an understanding relevant published literature. 3. Students will be inspired to continue learning beyond the course content as to how quantitative biology can be vital throughout biological research.
Required Texts & Materials	**Introduction to Probability and Statistics for Engineers and Scientists, Third Edition** - Sheldon M. Ross, Elsevier Academic Press **A hand-held calculator will be needed for all quizzes, problem sets and exams. Use of calculator programs on PDAs or similar devices is not permitted.**
Suggested Texts, Readings, & Materials	Assigned as appropriate

Assignments & Academic Calendar

[Topics, Due Dates, Exam Dates]

Date	Topics
08/23	Introduction of the course, Introduction of required knowledge (set, differential, integral, central dogma)
08/25	Descriptive statistics , introduction of R language
08/30	Introduction of probability, conditional probability
09/01	Probability calculation (I) (permutation and combination)
09/05	*Labor day holiday*
09/06	Quiz 1. Random variable, Mean and variance
09/07	*Last day to drop a class without a "W"*
09/08	Distribution function (I) (discrete distribution, Binomial, Poisson, negative binomial)
09/13*	Distribution function (II) (continuous distribution, normal, chi-square)
09/15*	Confidence interval
09/20	Quiz 2. Practice (I) of R in calculating probability and statistics
09/22*	Dependence, covariance of two random variables, correlation
09/27*	Linear regression (least square fitness), Principle component analysis
09/29	R practice (II)
10/04	Hypothesis testing, t-test
10/06	Review of classes for mid-term, Q&A
10/11	Mid-term (confidence interval, correlation, regression)
10/13	Introduction of microarray
10/18	Raw data analysis of microarray (I)
10/20	Raw data analysis of microarray (II); Multiple-testing adjustment
10/25	R practice (III) and BioConductor package
10/27	introduction of gene ontology; pathway analysis
11/01	Take home project distributed, Identify co-expressed genes (clustering)
11/03	Introduction of next generation sequencing and application
11/07	Last day to withdraw class with "W"
11/08	Introduce RNA-seq data analysis with DE-Seq
11/10	R practice (IV)
11/15*	Introduction of chip-chip
11/17*	ChIP-seq analysis with MACS
11/22-27	Fall break
11/29	Motif and position weight matrix
12/01	Motif discovery
12/06	Quiz 3. Review of class
12/09	Take home project due.

Exam Dates and Times

	Mid-term Exam: open-book exam, on 10/11/16 in class **Second Exam: Take home, due 12/09/16 11:59pm by email**

Course Policies

Grading (credit) Criteria	**Three in-class quizzes (10% each; 30% total); mid-term exam (40%); take-home exam (30%);**
Make-up Exams	**There are no make ups for in-class quizzes.**
Extra Credit	**N/A**
Late Work	**N/A**
Special Assignments	**N/A**
Class Attendance	**Students are responsible for obtaining any missed lecture material or assignments.**
Classroom Citizenship	***Cell-phone use:*, cellular telephones, and pagers must be turned off and put away during lectures and exams. Laptops are allowed only for learning course content.**
Comet Creed	*This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:* *"As a Comet, I pledge honesty, integrity, and service in all that I do."*
UT Dallas Syllabus Policies and Procedures	*The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus.* *Please go to http://go.utdallas.edu/syllabus-policies for these policies.*

These descriptions and timelines are subject to change at the discretion of the Instructors.