Philadelphia University
Faculty of Science
Department of Basic Sciences and Mathematics
Second (spring) Semester 2009/2010

Course Syllabus

Course Title	Advanced Applied Math	Course Code	250473
Course Level	"4"	Course Prerequisite	250311 "Real Analysis I"
Lecture Time	Sun., Tue., and Thu. 1:10–2:00	Credit Hours	"3"

Academic Staff Specific

Name	Feras Awad Mahmoud	Office Hours	Sun. Tues. Thurs.	08:10 – 09:00
Rank	Lecturer "M.Sc"			09:10 – 10:00
Office Number	"819"			11:10 – 12:00
Location	Faculty of Science		Mon. Wednes.	09:45 – 11:00
E – mail	math473@gmail.com			12:45 – 02:00

Course Description:

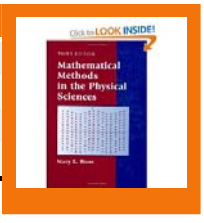
This course is particularly intended for the students who want to develop a basic competence in many areas of applied mathematics. The course covers many of important subjects. It starts with "Vector Analysis" and ends with "Applications of PDEs". Between these two subjects, the student will deal with new functions and formulas like Gamma, Beta, Error functions, Stirling's formula, Elliptic integrals and functions, Legendre polynomials, Bessel functions and orthogonal functions. Also, the student will learn some integral transforms like Laplace, Fourier transforms and Green functions.

Course Objectives:

1. Derive the formulas for the physical situations using vectors.
2. Understand and use the main theorems in vector calculus which are: Green's, Divergence and Stockes' Theorem
3. Understand the basic use for both the Gamma and Beta functions.
4. Solve the Legendre differential equation by series method and find the conditions necessary for a polynomial solution.
5. Derive and apply the generating function and recurrence relations for Legendre Polynomials.
6. Employ the orthogonality relation of Legendre polynomials to develop functions as series of such polynomials
7. Bessel equations.
8. Bessel functions of 1st and 2nd kind of integral order.
9. Definition and properties of the Laplace transform, applications to initial value problems, applications to systems of differential equations, the unit step function and the Dirac delta function, the convolution theorem.
10. Introduction to partial differential equations and some applications.

Course Components (Text Book):

Title	:	Mathematical Methods in the Physical Sciences
Author	:	Mary L. Boas
Publisher	:	John Wiley & Sons., Inc
Edition	:	3rd
Year	:	2006
ISBN	:	0471198269



TEACHING METHODS:

1. To learn it is imperative for the student to take an active interest in their own education .To learn mathematics the student must read, think, and write in an analytical manner and this takes practice .Such practice is by working exercises .When troubles arise, and they will, the student must ask questions .Questions may be posed to the instructor or to other students in a variety of ways; online office hours, or in class.
2. There are many different styles of learning .Some people gain better understanding from listening to something being explained orally .Some get better understanding from written material .Some like a combination of both .I do my best to accommodate various styles of learning .However, feel free to let me know what your learning style is so that I can take that into account when determining the future direction of the course.
3. There will be required readings associated with each lecture .Most readings will be from the course text, but students are encouraged to seek supplementary material .Links to supplementary reading material can be accessed from the course page.
4. Homework will be assigned each week; not to be collected or graded by the instructor .In addition, at the end of a chapter, challenge problems will be assigned for "work–hard " students .Furthermore, mathematical projects on real–life problems will be assigned to the students throughout the semester.
5. I encourage the use of research materials as a way to supplement your understanding of the course material, as long you heed the following common-sense ground rules .First, you may not consult my solutions or the problems sets of other students from previous offerings of this course .Second, external sources may be used only to improve your own understanding .You may not quote directly from any source and you should not write down anything that you do not understand .When you write your solutions, you should do it on your own without the direct help of any external sources .If you do use external references in improving your understanding, please cite them !Failure to cite references will be treated as cheating and will not be tolerated .If you are diligent about citing references, you will come out ahead in the end . Please ensure that you understand the spirit and the letter of these rules before beginning any class work.
6. You are encouraged to work together on problem sets, especially those designated as group work .However, unless the problem set is specifically designated as group work, you must ultimately demonstrate your understanding of the material by writing up your own solutions without the help of other students or their written work .If you consult with other students)or faculty (on a problem set, this should be considered equivalent to consulting any other reference and should be cited appropriately .This policy will be strictly enforced.
7. All assignments should be submitted electronically by e–mailing a file to the instructor by the beginning of the class period in which the assignment is due .The official turn–in time of the assignment will be the time stamp on the e–mail.
8. Higher learning involves not just acquiring knowledge, but developing the ability to know what you don't know .Among other things, this involves the ability to know when you do and do not have a rigorous proof or an accurate answer .One of the goals of this course is to cultivate your ability to perform an accurate self-assessment of your work .Hence, you are encouraged to think about and state accurately not only the parts that you do understand from each homework, but also the parts that you do not .Please do not muddle your way through proofs and other exercises in the hope that I will not read them carefully .You will get additional credit for an accurate self-assessment of your answer or approach .If you have gotten most of the way through a proof and just cannot complete the last step or even if you are missing a step in the middle but know how to do the rest, just try to write down what you have done so far and what it is that you don't know how to do .This will help me to better gauge where your understanding is incomplete so that we can review these areas in class .It will also demonstrate your understanding of your own work.
9. Effective learning also involves knowing where to go to get help when you realize that your knowledge or understanding of a topic is incomplete .This could mean consulting external references or coming to office hours .It can also mean asking a question in class when you don't understand part of the lecture.
10. I very much appreciate and enjoy getting as much feedback from my students as possible, even if it is not all positive .Please don't be afraid to tell me what you think .If you want to just stop

by to chat, feel free .My door is usually open, but if you could utilize office hours as much as possible, I would appreciate it .If you would like to make an appointment outside office hours, just call or send an e-mail.

LEARNING OUTCOMES:

1. To give the student the necessary information to deals with problems that could be a model for some physical and biological problems.
2. To give the student the necessary mathematical tools for further study in applied mathematics, where the Gamma function could be used in fractional calculus.
3. To demonstrate the ability to use orthogonal functions (Legendre, Hermite, others) in approximating D.E, or expanding functions.

ASSESSMENT INSTRUMENTS

Allocation of Marks				
Assessment Instruments	Mark	Expected Appointment		
		Date	Day	Time
First Examination	20	25.03.10	Thursday	1:10 – 2:00
Second Examination	20	07.05.10	Thursday	1:10 – 2:00
Homeworks and Projects	10	On Sunday from each Week.		
Final Examination	50	30.05.10 – 08.06.10		
Total	100			

COURSE ACADEMIC CALENDAR

Week	Basic and Support Material to be Covered
(1)	Chapter 06 :Vector Analysis. 1. Introduction. 2. Applications of Vector Multiplication.
(2)	3. Triple Products. 4. Differentiation of Vectors. 5. Fields.
(3)	6. Directional Derivative; Gradient. 7. Some Other Expressions Involving V. 8. Line Integrals.
(4)	9. Green's Theorems in the Plane. 10. The Divergence and the Divergence Theorem. 11. The Curl and Stokes' Theorem.
(5)	Chapter 11 :Special Functions. 1. Introduction. 2. The Factorial Function. 3. Gamma Function; Recursion Relation. 4. The Gamma Function of Negative Numbers. 5. Formulas Involving Gamma Functions. 6. Beta Functions.
(6) First Exam	7. Beta Functions in Terms of Gamma Functions. 8. The Simple Pendulum.
(7)	9. The Error Function. 10. Asymptotic Series. 11. Stirling's Formula. 12. Elliptic Integrals and Functions.
(8)	Chapter 12 : Legendre, Bessel, Hermite, and Laguerre functions. 1. Introduction. 2. Legendre's Equation. 3. Leibniz' Rule for Differentiating Products. 4. Rodrigues' Formula. 5. Generating Function for Legendre Polynomials.

(9)	6. Complete Sets of Orthogonal Functions. 7. Orthogonality of Legendre Polynomials. 8. Normalization of Legendre Polynomials. 9. Legendre Series.
(10)	10. The Associated Legendre Polynomials. 11. Bessel's Equation. 12. The Second Solutions of Bessel's Equation.
(11) Second Exam	13. Graphs and Zeros of Bessel Functions. 14. Recursion Relations.
(12)	15. Orthogonality of Bessel Functions. 16. Hermite and Laguerre Functions; Ladder Operators.
(13)	Chapter 13 :Partial Differential Equations. 1. Introduction. 2. Laplace's Equation; Steady-State Temperature. 3. The Diffusion of Heat Flow Equation; the Schrodinger Equation.
(14)	4. The Wave Equation; the Vibrating String. 5. Steady-State Temperature in a Cylinder. 6. Vibration of a Circular Membrane.
(15)	7. Steady-State Temperature in a Sphere. 8. Poisson's Equation. 9. Integral Transform Solutions of Partial Differential Equations.
(16)	Final Exam

EXPECTED WORKLOAD:

On average students need to spend, at least, 9 hours of study and preparation per week for this course.

ATTENDANCE POLICY:

Absence from lectures shall not exceed 15 .%Students who exceed the 15 %limit without a medical or emergency excuse acceptable to and approved by the Dean of the relevant college/faculty shall not be allowed to take the final examination and shall receive a mark of zero for the course .If the excuse is approved by the Dean, the student shall be considered to have withdrawn from the course.

MODULE REFERENCE(S)

Title	:	Schaum's Outline of Mathematica.
Author	:	Fourier Series; Transforms; and Boundary Value Problems.
Publisher	:	J. Ray Hanna and John H. Roland.
Edition	:	John Wiley & Sons., Inc
Year	:	2nd
ISBN	:	1990