KINGDOM OF SAUDI ARABIA
AL-IMAM UNIVERSITY
FACULTY OF SCIENCES

المملكة العربية
السعودية
جامعة الإمام محمد
بن سعود الإسلامية
كلية العلوم

Department of Physics

Course Code	Course Number	Course Name	Credit Hours	Lecture	Lab	Tut	Prerequisites
PHY	436	Computational Physics	3	3	1	0	CS140, MAT 251

Instructor	Dr. Ali Eid
Office	SR106-119
Phone	
Office Hours	

Course Materials

Textbook:

Title	
Authors	
Publisher	
Edition/Year	

Useful Resources:

1- Mathematical Methods for Physicists: A Concise Introduction, T. Chow, Cambridge University Press, 2000.
2- Mathematical Methods for Physics and Engineering, K.F. Riley, M.P. Hobson and S.J. Bence, 3th edition, Cambridge University Press, 2006.
3- Mathematical Methods for Physicists, George B. Arfken and Hans J. Weber, Academic Press; 6 edition, 2005.
4- Advanced Engineering Mathematics, E. Kreyszig, John Wiley & Sons , INC 8th ed (1998).
5- Computational Physics, Nicholas J. Giordano and H. Nakaanishi, Addison-Wesley, (2006).
6- Computational Physics, Steven E. Koonin, Addison-Wesley, New York,(1989).
7- An Introduction to Computational Physics, Tao Pang, Cambridge University Press, (2006).
8- Computational Physics, Richard Fitzpatrick, Texas University Press, 2006.
9- Computational Physics: Problem solving with Computer, 2nd edition, R.H. Landau, M.J. Paez and C.C. Bordeianu, Wiley-Vch Verlag Gmbh and Co. kGaA, 2007.

10- An Introduction to Computational Physics, Tao Pang, second Ed., Cambridge university press, 2006

Course Objectives:

- To teach students some important applied numerical mathematical tools.
- To let students be familiar with Computer algorithms and math. tools.
- To let students be familiar with Interpolation, Extrapolation and Data Fitting.
- To let students be familiar with the numerical ordinary differential equations and numerical integration.
- To let students be familiar with Partial differential equations, matrix algebra and some of its important applications

Other Requirements:

Exams: There will be three exams (mid term 1, mid term 2, and final). Examinations include short answers, and problems. These will be similar in type and content to class discussions. They are designed to test your comprehension of the course.

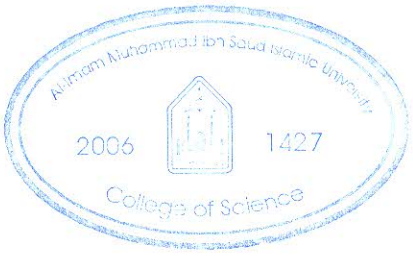
Classroom Participation: You are expected to participate in the classroom discussion by answering questions by asking good questions, raising issues, and making observations. No comment is considered "bad" as long as it makes a constructive class contribution. The instructor believes that a good learning environment is a safe environment—one in which all feel free to question and discuss. A sense of humor is always welcome!

Penalty For Dishonesty: Each student is expected to do his own work on all of the course material. Each person is expected to contribute equally on the class project and each team is expected to do their own work (not collaborate with others outside the team), otherwise each person involved will be subject to the University Dishonesty Policy.

Attendance: Attendance will be taken at the beginning of the class period. If you are late for a class, it is your responsibility to advise me at the end of the class that you were present. Failure to do so on the day in question will result in you being marked absent for that class. Mobile is not allowed to be used in class at all. Therefore, please keep it off during class time.

Grading:

Midterm 1: 20% Date: end of the 6th week
Midterm 2: 20% Date: end of the 12th week
Quiz, Research and Homework: 20%
Final Exam: 40% Date: end of the semester



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PHY	436	Computational Physics	3	3	1	0	Phy 355, MAT 251

Course Contents

Week	Topics to be covered	Hours
1	**Introduction:** *Overview - A Programming Language: Computer algorithms and languages, Using different software's, Applications: Newton and Kepler laws.*	4
2	***Finding roots of equations**: Bisection method- Newton's method- fixed point method. Algebraic and transcendental equations, Rearrangement of the equation.*	8
1- 1/2	**Interpolation** Polynomial interpolation, *linear interpolation*, quadratic interpolation, Lagrange interpolation, Newton difference method.	6
1-1/2	***Numerical Integration*** One dimensional integral: Rectangle rule; *Trapezium rule; Simpson's rule; Gaussian integration.*	6
1-1/2	***The method of least squares* (Data Fitting):** *Linear least squares; non-linear least squares.*	6
1-1/2	**Numerical solution of linear system (Matrix Algebra)** *Simultaneous linear equations; Gaussian elimination; Pivoting, LU and cholesky.*	6
1	***Iterative method**: Jacobi, Gauss–Seidel iteration; convergence and matrix norm, tridiagonal matrices.*	4
2	***Numerical solution of Differential equations*** Difference equations; *Euler and Picard methods* ; Taylor series solutions; System of equations. Runge– Kutta methods, Higher-order equations.	8
1	***Finite differences method for ordinary diff equations***	4
1	**Introduction to PDEs:** First order linear PDEs -Second order linear PDEs.	4