Course Specifications

General Information

Course name	Computional Physics
Course number	PHYS4372
Faculty	
Department	
Course type	Major Needs
Course level	4
Credit hours (theoretical)	3
Credit hours (practical)	0
Course Prerequisites	

Course Objectives

1 - The purpose of this course is demonstrate to students how computers can enable us to both broaden and deepen our understanding of physics by vastly increasing the range of mathematical calculations which we can conveniently perform

2 - 1. Students should be able solve mathematics and physics problems using Maple,

3 - 2. Students should be able to identifying the key physical principles and its constraints underlying

4 - 3. Student should be able tract the mathematical model/equations to carry out the analysis of the problem,

5 - If the model/equations are not tractable, develop a computer code using Maple to numerically simulate the model system;

6 - 5. Intelligently analyze, interpret, and assess the reasonableness of the answers obtained and/or the models predictions;

7 - 6. Effectively communicate their findings to diverse audience.

8 - 7. Have proficiency with standard methods of data analysis (e.g., graphing, curve-fitting, statistical analysis, Fourier analysis, etc.).

9 - 8. Intelligently analyze, interpret, and assess the reasonableness of their results

Course Contents

1 - Meeting 1: Basic Commands, getting started, help menu, calculator, precalculus, simple 2D plots,
2 - Meeting 2: Calculus, and Linear algebra,
3 - Meeting 3: Differential Equations, Harmonic Motions, Damped, Over Damped, Phase Plots and Stability of the Dynamic Systems, and Driven Oscillators.
4 - Meeting 4: Resistors in Series and in Parallel, Kirchhoff's Rules, RC circuits, Lissajous Figures
5 - Meeting 5: Maple plots and animations: 4-D plots
6 - Meeting 7: Light as an Electromagnetic Wave, Polarization, Mathematics of Interference, Double-slit Interference, Diffraction, Diffraction Grating
7 - Meeting 8: Coulomb's Law, Curvilinear Coordinates, Differential Vector Calculus, Electric Potential,
8 - Meeting 9: Boundary value problem, Laplace Equation in Cartesian Coordinates, Laplace Equation in Spherical Coordinates, Laplace Equation in Cylindrical Coordinates,
9 - Meeting 10: Step Potential, Infinite Potential,
10 - Meeting 11: Barrier Potential, Well Finite Potential,
11 - Meeting 12: Numerical solutions and curve fitting: interpolation and extrapolation
12 - Meeting 13: Simple Maple Programs
13 - Meeting 13: Simple Maple Programs

Teaching and Learning Methods

1 - interactive in computer lab

Teaching and Learning Methods for the Disabled Students

1 - Not applicable

Students Assessment

Assessment Method	TIME	MARKS
Meeting 6 Midterm	3 hour exam	40
Meeting 14	3 hours exam	50
attendance	absence is not allowed	10

Books and References

Course note	prepared by Prof. Hassan Ashour
Essential books	1. Frank Y. Wang, Physics with Maple, Wiley Dec 2005.
Recommended books	2. M. B. Monagan, K. O. Geddes, K. M. Heal, G. Labahn, S. M. Vorkoetter J. McCarron, P. DeMarco, Maple Introductory Programming Guide, Maplesoft 2008