



Kingdom of Saudi Arabia
The National Commission for Academic Accreditation &
Assessment

T6. Course Specifications (CS)

Course title: Computational Physics

Course code: 23064445-3

Course Specifications

Institution: Umm AL – Qura University	Date : 14/3/1439
College/Department : Jamoum University College – Physics Department	

A. Course Identification and General Information

1. Course title and code: Computational Physics 23064445-3			
2. Credit hours: 3 hrs.			
3. Program(s) in which the course is offered. BSc Physics. (If general elective available in many programs indicate this rather than list programs)			
4. Name of faculty member responsible for the course One of the staff members			
5. Level/year at which this course is offered : 3rd Year / Level 4			
6. Pre-requisites for this course (if any) : Theoretical Methods in Physics (2) 23063242-4			
7. Co-requisites for this course (if any) : ---			
8. Location if not on main campus: Al-Jamoum			
9. Mode of Instruction (mark all that apply)			
a. traditional classroom	<input checked="" type="checkbox"/>	What percentage?	100%
b. blended (traditional and online)	<input type="checkbox"/>	What percentage?	<input type="text"/>
c. e-learning	<input type="checkbox"/>	What percentage?	<input type="text"/>
d. correspondence	<input type="checkbox"/>	What percentage?	<input type="text"/>
f. other	<input type="checkbox"/>	What percentage?	<input type="text"/>
Comments:			

B Objectives

1. What is the main purpose for this course?

This course is designed to provide a variety of computational techniques for the Physical Sciences. A major goal of this course is to teach the student how to solve scientific problems using calculus software. In particular, the student will use the computational software, like MATLAB, in order to increase active learning in physics. This will enable student to perform

- Physical problems both numerically and analytically.
- Interactive simulations.

2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field)

1. Understand computer hardware
2. Design flowcharts of scientific problems
3. Solve some computational physics problems using MATLAB.
4. Analyze and plot data,
5. Develop algorithms, and create models and applications using MATLAB.
6. Write well-structured C++ programs.

C. Course Description (Note: General description in the form used in Bulletin or handbook)

Course Description:

The course provides a direct preparation to solve scientific problems using calculus software High Level Languages. In particular, the student will use C/C++ Languages and the computational software, like MATLAB, in order to increase active learning in physics. This will enable student to perform:

- Well-structured C++ programs.
- Physical problems both numerically and analytically.
- Interactive simulations.

1 Topics to be Covered

Topics	No of Weeks	Contact hours
❖ Basics: Variables and arrays, creating and initializing variables, Multidimensional array, sub-arrays, Special values, Displaying output data, Data files, scalar and array operations, Built in functions, Introduction to plotting, examples.	2	6
❖ Program Design and Control Structures: The logical data type, Branches, Additional plotting features, the while Loop, the FOR Loop, Logical arrays, Vectors, examples, Solving exercises.	2	6
❖ Using defined functions:	2	6

MATLAB functions, Variable passing, optional arguments, sharing data using Global memory, Preserving data between calls to a function, sub – Functions and private – functions, examples.		
❖ Complex data: Complex variables, using complex numbers with relational operators, Complex functions, plotting complex data, examples and exercises.	2	6
❖ Linear Algebra: Solving a linear system, Gaussian elimination and exercises, Finding eigenvalues and eigenvectors, Matrix factorizations and examples.	1	3
❖ Curve fitting and interpolation: Polynomial fitting, Least square fitting, non-linear fits and examples, interpolation of data.	1	3
❖ Numerical integration and differentiations: Integration, differentiations, solving first order and second order Linear equation.	1	3
❖ Introduction to programming language C++: Flow Charts and Algorithms, Basic Elements of C++ language, Constructing, compiling and building simple program, Some programming techniques (looping, branching, etc...), Array Processing, Formatted I/O and File Processing, Some applications.	4	12
	15 weeks	45 hrs

2. Course components (total contact hours and credits per semester):						
	Lecture	Tutorial	Laboratory or Studio	Practical	Other:	Total
Contact Hours	45		--			45
Credit	4		--			

3. Additional private study/learning hours expected for students per week.	4
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4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

On the table below are the five NQF Learning Domains, numbered in the left column.

First, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table).

Second, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes.

Third, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	Knowledge		
1.1	Define the physical quantities, physical phenomena, and basic principles.	1- Demonstrating the basic principles through lectures. 2. Discussing phenomena with illustrating pictures and diagrams. 3. Lecturing method: Board, Power point. 4. Discussions 5. Brain storming 6. Start each chapter by general idea and the benefit of it.	Solve some example during the lecture. Discussions during the lectures Exams: a) Quizzes (E-learning) b) Short exams (mid- term exams) c) Long exams (final) d) Oral exams
1.2	Describe the physical laws and quantities using mathematics		
2.0	Cognitive Skills		
2.1	Apply the laws of physics to calculate some quantities.	1. Preparing main outlines for teaching. 2. Following some proofs. 3. Define duties for each chapter	1. Exams (Midterm, final, quizzes) 2. Asking about physical laws previously taught
2.2	Solve problems in physics by using suitable mathematics.		
2.3	Analyse and interpret quantitative results.		

2.4	Apply physical principle on day life phenomena.	4. Encourage the student to look for the information in different references. 5. Ask the student to attend lectures for practice solving problem.	3. Writing reports on selected parts of the course. 4. Discussions of how to simplify or analyze some phenomena.
2.5	Derive the physical laws and formulas.		
3.0	Interpersonal Skills & Responsibility		
3.1	Show responsibility for self-learning to be aware with recent developments in physics	<ul style="list-style-type: none"> • Search through the internet and the library. • Small group discussion. • Enhance self-learning skills. • Develop their interest in Science through : (lab work, visits to scientific and research institutes). 	<ul style="list-style-type: none"> • Evaluate the efforts of each student in preparing the report. • Evaluate the scientific reports. • Evaluate the team work in lab and small groups. • Evaluation of students presentations.
3.2	Work effectively in groups and exercise leadership when appropriate.		
4.0	Communication, Information Technology, Numerical		
4.1	Communicate effectively in oral and written form.	<ul style="list-style-type: none"> • Incorporating the use and utilization of computer, software, network and multimedia through courses • preparing a report on some topics related to the course depending on web sites 	<ul style="list-style-type: none"> • Evaluating the scientific reports. • Evaluating activities and homework
4.2	Collect and classify the material for the course.		
4.3	Use basic physics terminology in English.		
4.4	Acquire the skills to use the internet communicates tools.		
5.0	Psychomotor (NA)		

5. Map course LOs with the program LOs. (Place course LO #s in the left column and program LO #s across the top.)

Course LOs #	Program Learning Outcomes (Use Program LO Code #s provided in the Program Specifications)															
	1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5	3.1	3.2	4.1	4.2	4.3	4.4	5.1	5.2
1.1	✓															
1.2		✓														
1.3																
2.1				✓												
2.2					✓											
2.3						✓										
2.4							✓									
2.5								✓								
3.1									✓							
3.2										✓						
4.1											✓					
4.2												✓				
4.3													✓			
4.4														✓		
5.1																
5.2																

6. Schedule of Assessment Tasks for Students During the Semester

	Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Exercises & Home works	All weeks	10 %
2	Participation	All weeks	10 %
3	In-Class Problem Solving	All weeks	10 %
4	Midterm 1	6 th week	10 %
5	Midterm 2	12 th week	10 %
6	Final Exam	16 th week	50 %

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)
Each student will supervise by academic adviser in physics Department and the time table for academic advice were given to the student each semester. (4hrs per week)

E Learning Resources

1. List Required Textbooks
 - 1- Object oriented programming in C++, Robert Lafore, 4th edition, Pearson & Sam Publishing (2001).
 - 2- Object oriented programming using C++, Joyce Farrel, fourth edition, 2009.
 - 3- Getting started with MATLAB, Rudra Pratap, New York, 2010, ISBN: 978-0-19-973124-4
 - 4- MATLAB, "An introduction with Applications", fourth edition, Amos Gilat, John Wiley and Sons, INC, 2011.
 - 5- Essentials of MATLAB programming, Second Edition, Stephen J. Chapman, 2009.
2. List Essential References Materials (Journals, Reports, etc.)
3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)
Solving Applied Mathematical problems with MATLAB, DINGYU XUE and YANGQUAN CHEN, CRC Press, 2009 by Taylor and Francis Group, ISBN-13: 978-1-4200-8250-0
4. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
 1. www.mpi-pks-dresden.mpg.de/~jochen/methoden/outline.html
 2. People.uncw.edu/hermanr/phy311/mathphysbook/index.html
5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access etc.)

<p>1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)</p> <ul style="list-style-type: none"> • Class room is already provided with data show. • The area of class room is suitable concerning the number of enrolled students (68) and air conditioned. • Library. • Laboratory for fundamental of physics.
<p>2. Computing resources (AV, data show, Smart Board, software, etc.)</p> <ul style="list-style-type: none"> • Computer room. • MATLAB software.
<p>3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)</p>

G Course Evaluation and Improvement Processes

<p>1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching</p> <ul style="list-style-type: none"> • Course reports • Course evaluation.
<p>2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department</p> <ul style="list-style-type: none"> • Revision of student answer paper by another staff member. • Analysis the grades of students.
<p>3 Processes for Improvement of Teaching</p> <ul style="list-style-type: none"> • Preparing the course as PPT. • Using scientific flash and movies. • Coupling the theoretical part with laboratory part • Periodical revision of course content.
<p>4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution)</p> <ul style="list-style-type: none"> • The instructors of the course are checking together and put a unique process of evaluation. • Check marking of a sample of papers by others in the department. • Feedback evaluation of teaching from independent organization. • Independent evaluation by another instructor that give the same course in another faculty. • Evaluation by the accreditation committee in the university.
<p>5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.</p> <p>1- The following points may help to get the course effectiveness</p> <ul style="list-style-type: none"> • Student evaluation • Course report • Program report • Program Self study <p>2- According to point 1 the plan of improvement should be given.</p>