جامعة أم القرى

كلية العلوم التطبيقية

الماجستير في الفيزياء بالمقررات والمشروع البحثي

4. Learning and Teaching

4/1/1 Main tracks or specializations covered by the program:

(a) Nuclear and High Energy Physics
(b) Optics and Photonics
(c) Material Science

4/1/2 Curriculum Study Plan

Level	Course Code	Course Title	Required or Elective	Prerequisite Courses	Credit Hours
Level 1	403600	Mathematical Physics	Required		3
	403602	Statistical Physics	Required		3
	403604	Electrodynamics	Required		3
	403606	Computational Physics	Required		3
	Semester Hours				12
Level 2	4036XX	Phys. 601, 621 & 631	Elective	Academic guide	3
	4036XX	Phys. 603, 623 & 633	Elective	Academic guide	3
	4036XX	Phys. 605, 625 & 635	Elective	Academic guide	3
	4036XX	Phys. 607, 627 & 637	Elective	Academic guide	3
	Semester Hours				12
Level 3	4036XX	Phys. 608, 618 & 624	Elective	Academic guide	3
	4036XX	Phys. 610, 620 & 626	Elective	Academic guide	3
	4036XX	Phys. 612, 622 &,628	Elective	Academic guide	3
	403614	Research Methodology	Required	Academic guide	3
	Semester Hours				12
Level 4	403616	Special topics*	Required	Academic guide	2
	403617	Research Project	Required	Academic guide	5
	403619	Seminar**	Required	Department approval	1
	Semester Hours				8
	Total Hours				44
	*This course is proposed by faculty members based on students 'track and new trends in Physics. **Scheduled discussions of current problems in physics, centered around guest lecturer and student presentations. It is designed to acquaint the graduate student with current research areas in physics.				

Include additional levels or courses if needed

4/1/2/1 Curriculum Study Plan (Nuclear and High energy physics track)

Level	Course Code	Course Title	Required or Elective	Prerequisite Courses	Credit Hours
Level 1	403600	Mathematical Physics	Required		3
	403602	Statistical Physics	Required		3
	403604	Electrodynamics	Required		3
	403606	Computational physics	Required		3
	Semester Hours				12
Level 2	403601	Introduction to Nuclear &High Energy Physics	Required	Academic guide	3
	403603	Quantum Field theory	Required	Academic guide	3
	403605	Nuclear Reactions	Required	Academic guide	3
	403607	Detector Physics	Required	Academic guide	3
	Semester Hours				12
Level 3	403608	High Energy Physics	403603	Academic guide	3
	4036XX	Phys. 610, 620 & 626	Elective	Academic guide	3
	403612	Computational methods in Medical physics	403606	Academic guide	3
	403614	Research Methodology	Required	Academic guide	3
	Semester Hours				12
Level 4	403616	Special topics*	Required	Academic guide	2
	403617	Research Project	Required	Academic guide	5
	403619	Seminar**	Required	Department approval	1
	Semester Hours				8
	Total Hours				44
Elective Courses	403610	Advanced Programming		Academic guide	3hrs
	403620	Semiconductor device modelling			3hrs
	403626	Advanced Research Lab.			3hrs
	*This course is proposed by faculty members based on students 'track and new trends in Physics. **Scheduled discussions of current problems in physics, centered around guest lecturer and student presentations. It is designed to acquaint the graduate student with current research areas in physics.				

Include additional levels or courses if needed

4/1/2/2 Curriculum Study Plan (Optics and Photonics track)

Level	Course Code	Course Title	Required or Elective	Prerequisite Courses	Credit Hours
Level 1	403600	Mathematical Physics	Required		3
	403602	Statistical Physics	Required		3
	403604	Electrodynamics	Required		3
	403606	Computational Physics	Required		3
	Semester Hours				12
Level 2	403621	Advanced Optics	Required	Academic guide	3
	403623	Numerical methods in photonics	Required	Academic guide	3
	403625	Quantum Optics	Required	Academic guide	3
	403627	Optical Wave Propagation	Required	Academic guide	3
	Semester Hours				12
Level 3	403618	Laser Physics and Optoelectronics	403621	Academic guide	3
	4036XX	Phys. 610, 620 & 626	Elective	Academic guide	3
	403622	Bio-photonics	403621	Academic guide	3
	403614	Research Methodology	Required	Academic guide	3
	Semester Hours				12
Level 4	403616	Special topics*	Required	Academic guide	2
	403617	Research Project	Required	Academic guide	5
	403619	Seminar	Required	Department approval	1
	Semester Hours				8
	Total Hours				44
Elective Courses	403610	Advanced Programming		Academic guide	3hrs
	403620	Semiconductor device modelling			3hrs
	403626	Advanced Research Lab.			3hrs
	*This course is proposed by faculty members based on students 'track and new trends in Physics. **Scheduled discussions of current problems in physics, centered around guest lecturer and student presentations. It is designed to acquaint the graduate student with current research areas in physics				

Include additional levels or courses if needed

4/1/2/3 Curriculum Study Plan (Material Science track)

Level	Course Code	Course Title	Required or Elective	Prerequisite Courses	Credit Hours
Level 1	403600	Mathematical Physics	Required		3
	403602	Statistical Physics	Required		3
	403604	Electrodynamics	Required		3
	403606	Computational Physics	Required		3
	Semester Hours				12
Level 2	403631	Solid State Physics	Required	Academic guide	3
	403633	Advanced Crystallography	Required	Academic guide	3
	403635	Characterization techniques	Required	Academic guide	3
	403637	Physical Properties of solid materials	Required	Academic guide	3
	Semester Hours				12
Level 3	403624	New and Renewable Energy	403631	Academic guide	3
	4036XX	Phys. 610, 620 & 626	Elective	Academic guide	3
	403628	Nanotechnology in Medicine	403631	Academic guide	3
	403614	Research Methodology	Required	Academic guide	3
	Semester Hours				12
Level 4	403616	Special topics*	Required	Academic guide	2
	403617	Research Project	Required	Academic guide	5
	403619	Seminar**	Required	Department approval	1
	Semester Hours				8
	Total Hours				44
Elective Courses	403610	Advanced Programming		Academic guide	3hrs
	403620	Semiconductor device modelling			3hrs
	403626	Advanced Research Lab.			3hrs

*This course is proposed by faculty members based on students 'track and new trends in Physics.
**Scheduled discussions of current problems in physics, centered around guest lecturer and student presentations. It is designed to acquaint the graduate student with current research areas in physics

Include additional levels or courses if needed

8/10 Course Specification

Table of Contents

Common courses

Course Title: Mathematical Physics

Course Code: 403600-3

(C-1)

Date: 20 .....-.....-....	**Institution: UMM AL– QURA UNIVERSITY**
College: Applied Science **Department: Physics**	

A. Course Identification and General Information

1. Course title and code: **Mathematical Physics - 403600-3**
2. Credit hours: **3 hours**
3. Program(s) in which the course is offered. **MSc in Physics** (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course
5. Level/year at which this course is offered: **Level 1/ 1st Year**
6. Pre-requisites for this course (if any):
7. Co-requisites for this course (if any):
8. Location if not on main campus: **Main campus and Al-Zaher Branch**

9. Mode of Instruction (mark all that apply):

a. Traditional classroom	✓	percentage?	50%
b. Blended (traditional and online)		percentage?	
c. E-learning	✓	percentage?	50%
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

1. Tutorial Videos (plus a question library) are created by one of the Faculty members (Prof. Khaled Abdel-Waged) for Chapters 1-4 of the course. The online teaching is installed on the E-Learning Gate of Umm Al-Qura University.
2. In this course, the student should also evaluate problems and plot graphs by a computer.

B Objectives

1. The main objective of this course

After completing this course student should be able to:

1. Create tensors from the formulas based on undergraduate-level course texts (e.g., Classical Mechanics, Electrodynamics)
2. Write physics laws in a form independent of the frame of reference.
3. Use Fourier and Laplace transforms and calculate solution of differential equations by Laplace transform.
4. Use Legendre function, Bessel equation, and Laguerre function as solutions of some types of differential equations
5. Deal with Functions of a complex variable, and contour integrals, and use them to find residues and to calculate definite integrals as well as differential equations.
6. Be familiar with the mathematical formulae of this course that frequently appear in physics problems.
7. Use computer to construct graphs of some functions.

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

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description: The objective of this course is to learn in a practical manner the mathematical techniques and methods useful in M.Sc. For example, tensor is the best instrumental tool for dealing with the modern part of physical science. This includes theory of relativity and its applications in elementary particle physics. This course is written with the object of providing more elementary prospective of this subject, enabling the student to be more acquainted with tensor methods as early as possible. The course is also designed to supply students for a variety of mathematical methods that need for beginning graduate study in physical science and to develop a solid background for those who will continue into the mathematics of advanced theoretical physics.

Knowledge and skills:

1. Learning fundamentals of Mathematical Physics.
2. Understand how to use mathematics as a tool for physics.
3. Understand how to translate a physical problem in mathematical form.
4. Ability to solve Physical problems analytically in an efficient way.

5. Become familiar with the basic of Tensors and freeing up precious time in learning the fact that the laws of physics should be independent of the frame of references.

1. Topics to be Covered		
List of Topics	**No. of Weeks**	**Contact hours**
1-Suffix notation -Introduction to suffix notation -The Kronecker delta -The alternating tensor -The relation between Levi Civita and Kronecker delta, -Grad, div and curl in suffix notation	1	3
2-Cartesian tensors -Orthogonal transformations -Symmetry transformations -Vectors and scalar -Examples.	2	6
3- Curvilinear coordinates -Scale factor and basis vectors -General curvilinear coordinates -Vector operators in orthogonal curvilinear coordinates.	2	6
4-Tensors in Curvilinear coordinates -A covariant and contravariant vectors, -Mixed tensors -Properties of tensors -Metric tensor -Construction of higher order tensors	2	6

5-Differential equations of the special functions -Lagendre functions -Bessel functions - Hermite functions -Laguerre functions.	2	6
6-Functions of a complex variable -Analytic functions -Cauchy-Riemann -Contour integrals - The residue theorem	2	6
7-Integral Transform -The Fourier transform -Application of Fourier transform to differential equations -Laplacian Transform -Laplace transform and differential equations	2	6
8-Integral Equation -Transformation of a differential equation into an integral equation -Integral Equations with Generating functions -Separable Kernels	2	6
Total	15	45

2. Course components (total contact and credit hours per semester):

		Lecture	**Tutorial**	**Laboratory/ Studio**	**Practical**	**Other**	**Total**
Contact Hours	Planned	45 hrs				45 hrs	90 hrs
	Actual	45 hrs				45 hrs	90 hrs
Credit	Planned	45 hrs				45 hrs	90 hrs
	Actual	45 hrs				45 hrs	90 hrs

3. Individual study/learning hours expected for students per week.	**8 hrs**
Online quizzes each week to help students understand the basics of each chapter (1/2 hour)	

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	**NQF Learning Domains And Course Learning Outcomes**	**Course Teaching Strategies**	**Course Assessment Methods**
1.0	**Knowledge**		
1.1	Upon successful completion of this course. The student will be able to: -Employ a new and powerful notation, suffix notation, for manipulating complicated vector expressions.	1-Demonstrating the basic information and principles through lectures 2- Lecturing method: - Blackboard -e-learning 3-Tutorials 4- Build a strategy to solve a problem.	1. Solve some example during the lecture. 2. Exams: • Online Quizzes • First mid-term exam • Second Midterm exam • Oral exams • Final exams 3. Discussions with the students. 4. Ask the student to clear the misunderstanding of some mathematical principle. 5.Ask quality question.
1.2	- Understand the general theory of non-Cartesian coordinate systems.		
1.3	-Understand the reason why the tensor analysis is used and explain usefulness of the tensor analysis.		
1.4	- Derive base vectors, metric tensors and strain tensors in an arbitrary coordinate system.		
1.5	-Know something about the		

	Special functions: graphs; formulas for derivatives and integrals.	1. Start each chapter by general idea and the benefit of it; 2. Learn the student background of the subject; 3. Show the best ways to deal with problem; 4. Keep the question "why" or "how" to explain always there; 5. Build a strategy to solve problem	
1.7	-Understand the basic ideas of complex analysis, with particular emphasis on Cauchy's Theorem and the calculus of residues.		
1.8	-Approach more advanced aspects of transform methods		
1.9	-Understand the relationship between integral and differential equations and transform one type into another.		
2.0	**Cognitive Skills**		
2.1	Having successfully completed the course students should be able to: - Write down quantities that run to several lines using conventional vector notation by suffix notation.	1. Preparing main outlines for teaching 2. Following some proofs 3. Define duties for each chapter 4. Homework assignments 5. Encourage the student to look for the information in different references 6. Ask the student to attend lectures for practice solving problem 7. Ask the student to do small research	1. Midterm's exam. Exams, short online quizzes 2. Asking about physical laws previously taught 3. Writing reports on selected parts of the course 4. Discussions of how to simplify or analyze some phenomena
2.2	- Write down the formulae for grad, div and curl in Curvilinear coordinates.		
2.3	-Apply tensors for invariance.		
2.4	-Build up a solid background of tensor calculus.		
2.6	- Work out with special functions that occur often in applications		
2.7	-evaluate integrals along a path . -compute the Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residues,		

	-prove the Cauchy Residue Theorem and use it to evaluate integrals.		
2.8	-Calculate the Fourier transform of elementary functions from the definition. -Calculate the Laplace transform of standard functions both from the definition and by using tables-- -Apply Fourier transform to differential equations -Apply Laplace transform to differential equations		
2.9	Solve linear Volterra and Fredholm integral equations using appropriate methods		
3.0	**Interpersonal Skills & Responsibility**		
	. The students learn independently and take up responsibility.	1. Learn how to use the E. learning gate of Umm Al-Qura University. 2. Learn how to cover missed lectures. 3. Learn how to summarize lectures or to collect materials of the course. 4. Learn how to solve difficulties in E. learning: solving problems – enhance educational skills. 5. Develop her interest in Science through :(lab work, field trips, visits to scientific and research. Encourage the student to attend lectures regularly by: ▪ Giving bonus marks for attendance ▪ Assigning marks for attendance. ▪ give students tasks of duties	1. Online Quizzes on the previous lecture 2. Creating reports 3. Discussion 4. The accuracy of the result gained by each group will indicate good group work 5. Presenting the required research on time and the degree of the quality will show the sense of responsibility.
4.0	**Communication, Information Technology, Numerical**		
4.1	Problem solving		
4.2	Data analysis and interpretation.		
4.3	Feeling physical reality of results		
5.0	**Psychomotor(if any)**		
5.1	Not Applicable		

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Online quizzes	All weeks	20%
2	Mid Term (1)	6th week	15%
3	Mid Term (2)	13th week	15%
4	Scientific project	14th Week	10%
5	Final Exam	16th week	50%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per 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.

E Learning Resources

1. List Required Textbooks

1- George Arfken, Mathematical Methods for physicists, seventh edition, Academic press (2014) ISBN: 0-12-059876-0

2- Mary L. Boas, Mathematical methods in the Physical sciences, third edition, John Wiley and Sons (2006) ISBN 0-471-19826-9

3- G. Dennis Zill, R. Michael Cullen, Advanced engineering mathematics, Jones and Bartlett Publisher (2006), ISBN 9780763745912.

4- Sadri Hassani, Mathematical methods for students of physics and related fields; Springer Science+Buisness Media LLC (2009): ISBN: 978-0-387-09503-5.

5- Applications of tensor analysis, Dover applications, Inc., New York (2011), eISBN-13: 978-0-486-14502-0.

6- Tensors and Manifolds: with applications to physics, Robert H. Wasserman, Library of congress (2009), ISBN 978-0-19-851059-8.

2. List Essential References Materials (Journals, Reports, etc.)

Journalcra.com/article/applications-tensor-various-scientific-and-mathematics…

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

(eg. www.youtube.com.)

4. 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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) ● Class room is already provided with data show • Computer Lab provided with data show • The area of class room is suitable concerning the number of enrolled students and air conditioned. • King Abdulah Library (Umm Al-Qura University)
2. Technology resources (AV, data show, Smart Board, software, etc.)
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching • Questionaries using the e-learning gate of Umm Al-Qura university • Open discussion in the class room using the e-learning gate of Umm Al-Qura university.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • Revision of student answers by another staff member. • Analysis the grades of students using the e-learning gate of Umm Al-Qura University..
3. Procedures for Teaching Development • Preparing the course as PPT. • Using the e-learning gate of umm Alqura university • Using scientific movies. • Coupling the theoretical part with laboratory part • Periodical revision of course content.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) • After the agreement of Department and Faculty administrations
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it.

- Periodical revision by Quality Assurance Units in the Department and institution

Name of Course Instructor: Atef Ismail

Signature: _____ **Date Completed:** _____

Program Coordinator: Khaled Abdel-Waged

Signature: _____ **Date Received:** _____

Course Title: Statistical Physics

Course Code: 403602-3

(C-2)

Date: 20....-.....-.....	**Institution:** UMM AL – QURA UNIVERSITY.
College: Faculty of Applied Science.	**Department:** Department of physics.

A. Course Identification and General Information

1. Course title and code: **Statistical Physics** (**403602-3**)
2. Credit hours: **3 hrs**.
3. Program(s) in which the course is offered. **M.Sc. 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 academic staff member**
5. Level/year at which this course is offered: **1st Year / Level 1**
6. Pre-requisites for this course (if any): Thermal Physics (B.Sc)
7. Co-requisites for this course (if any):
8. Location if not on main campus: **Main campus**
9. Mode of Instruction (mark all that apply):

a. Traditional classroom	✓	percentage?	100
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

- Apply the ideas of statistical mechanics to ideal and diatomic gases.
- Foster a qualitative understanding of the central concepts of entropy and chemical potentials.
- Treat the interchange rule of identical particles in the framework of statistical mechanics.

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

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

The course gives the mathematical treatment of the concept of probability, study fundamental principles of thermodynamics and statistical mechanics, including, kinetic theory, entropy, classical statistical mechanics, ensembles, quantum statistical mechanics, ideal Bose and Fermi systems, and phase transitions.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
The Canonical Ensemble: Method of the most probable distribution; The evaluation of the undetermined multipliers; Thermodynamic connections; Grand canonical ensemble.	2	4
Boltzmann, Fermi-Dirac and Bose-Einstein Statistics. The Maxwell-Boltzmann distribution function, the Bose-Einstein distribution function, the Fermi-Dirac distribution functions.	2	4
Ideal Monoatomic gas; The translational partition function; The electronic and Nuclear partition functions; Thermodynamic functions	2	4

Ideal Diatomic gas: The vibrational partition function; The rotational partition function of a heteronuclear diatomic molecule; The Symmetry requirement of the total wavefunction of a homonuclear diatomic molecule; The rotational partion function of a homonuclear diatomic molecule.	2	4
The Classical partition function: Phase-space and the Liouville equation; Equi-partition of energy.	2	4
Chemical Equilibrium: The Equilibrium constant in terms of partition functions; A weakly degenerate ideal Fermi-Dirac gas; A strongly degenerate ideal Fermi gas; A weaky degenerate ideal Bose -Einstein gas; A strongly degenerate ideal Bose - Einstein gas; An ideal gas of photons.	2	4
Quantum Statistical mechanics: Micro-canonical ensemble, Quantization of phase-space, Symmetry of wave functions, Effect of Symmetry on counting, Various distributions using micro-canonical ensemble.	3	4
	15 weeks	28 h.

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	45 hrs	45 hrs	----------	---------	-------	90 hrs
	Actual	45 hrs	45 hrs				90 hrs
Credit	Planned	45 hrs	45 hrs				90 hrs
	Actual	45 hrs	45 hrs				90 hrs

3. Individual study/learning hours expected for students per week. **8 hrs.**

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate

assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
	Upon successful completion of this course. The student will be able to:	-Lectures -Compulsory exercises.	-Online quizzes -Oral Exams -Written Exams
1.1	-give an account of the relevant quantities used to describe macroscopic systems, thermodynamic potentials and ensembles.		
1.2	-give an account of the macroscopic and microscopic description of temperature, entropy and free energy and their descriptions in terms of probabilities		
1.3	-describe the importance and consequences of quantum mechanics for macroscopic particle systems		
1.4	-understand quantum and classical statistical mechanics for ideal systems		
1.5	-able to judge when quantum effects are important		
1.6	-understand the connection between microphysics and thermodynamics.		
2.0	**Cognitive Skills**		
	Having successfully completed the course students should be able to:	-Lectures -Compulsory exercises.	-Small projects
2.1	-perform quantitative calculations on ideal systems		
2.2	-able to formulate models of more realistic systems		
2.3	-apply the theory to understand gases and crystals .		
2.4	-able to construct microscopic models and from these derive thermodynamic observables.		
3.0	**Interpersonal Skills & Responsibility**		

3.1	-apply techniques from statistical mechanics to a range of situations.	Small group discussion.	-Small projects -Oral Presentation
3.2	-use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanations.		
4.0	**Communication, Information Technology, Numerical**		
	The student should be able to	-group discussion	-Small projects -Oral Presentation
4.1	-use standard numerical packages for simulation and analysis of realistic systems.		
5.0	**Psychomotor(if any)**		
5.1	Not applicable.	Not applicable.	Not applicable.

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Midterm 1	5th week	10 %
2	Midterm 2	10th week	10 %
3	quizzes	During the semester	10%
4	Oral exam	During the semester	10 %
5	Home works	During the semester	10%
6	Final exam	15th week	50%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week)

E Learning Resources

1. List Required Textbooks

- -Thermodynamics, Kinetic theory, and statistical thermodynamics, 3rd edition, Francis W. Sears and Gerhard L. Salinger. ISBN-13: 978-0201068948 (1975).
- -Statistical thermodynamics revised printing, by Chang L. Tien and John H. Lienhard, ISBN-13: 978-0891168287 (1979).
- -M.D. Sturge, Statistical and Thermal Physics, Fundamentals and Applications (A.K. Peters, Natick, Massachusetts) ISBN 1-56881-196-9 (2003).

-John Dirk Walecka , Introduction to Statistical Mechanics: First Edition, ISBN-13: 978-9814366212 (2011). John Dirk Walecka, INTRODUCTION TO STATISTICAL MECHANICS: SOLUTIONS TO PROBLEMS Paperback , ISBN-13: 978-9814366205 (2016). Werner Krauth, Statistical Mechanics: Algorithms and Computations (Oxford Master Series in Physics) PAP/CDR Edition, ISBN-13: 978-0198515364 (2006).
2. List Essential References Materials (Journals, Reports, etc.)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. .Electronic Materials, Web Sites etc.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. There are so many computer programs that can be used Mathematical program, Maple, Matlab, etc

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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) The area of class room is suitable concerning the number of enrolled students (30) and air conditioned.
2. Technology resources (AV, data show, Smart Board, software, etc.) • Computer Lab..
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching • Questionnaires • Open discussion in the class room at the end of the lectures
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • Revision of student answer paper by another staff member. • Analysis the grades of students.
3. Procedures for Teaching Development • Course report. • Program report and Program self-study and a tutorial lecture

4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) • After the agreement of Department and Faculty administrations.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. • Periodical revision by Quality Assurance Units in the Department and institution

Name of Course Instructor: Ahmed El-Hady.

Signature: _____ Date Completed: _____

Program Coordinator: Khaled Abdel-Waged

Signature: _____ Date Received: _____

Course Title: **Electrodynamics**

Course Code: **403604-3**

(C-3)

Date: 27/9/2018	**Institution:** Umm AL – Qura University
College: College of Applied Science	**Department:** Department of Physics

A. Course Identification and General Information

1. Course title and code: **Electrodynamics (code: 403604)**
2. Credit hours: **3 Hrs**
3. Program(s) in which the course is offered. **Master of Physics;**

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course

   Walid Belkacem Belhadj & Mohamed M. Sabry
5. Level/year at which this course is offered: **1st Year / Level 1**
6. Pre-requisites for this course (if any):
7. Co-requisites for this course (if any):
8. Location if not on main campus: **Main campus and Alzaher**
9. Mode of Instruction (mark all that apply):

a. traditional classroom	✓	What percentage?	90
b. blended (traditional and online)		What percentage?	
c. e-learning	✓	What percentage?	10
d. correspondence		What percentage?	
f. other		What percentage?	

Comments:

B Objectives

1. The main objective of this course

The main purpose of this course is to apprise the students regarding the concepts of electrodynamics and Maxwell equations and use them various situations.

On completion of the course the student shall be able to:

- Formulate potential problems within electrostatics, magnetostatics and stationary current distributions in linear, isotropic media, and also solve such problems in simple geometries using separation of variables and the method of images.
- Define and derive expressions for the energy both for the electrostatic and magnetostatic fields, and derive Poynting's theorem from Maxwells equations and interpret the terms in the theorem physically.
- Describe and make calculations of plane electromagnetic waves in homogeneous media, including reflection of such waves in plane boundaries between homogeneous media.

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

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

This course is a graduate subject on electromagnetic wave theory, emphasizing mathematical approaches, problem solving, and physical interpretation. Topics covered include: Potential theory for electrostatics and magnetostatics, Maxwell's Equations and Conservation laws, Poynting's Theorem, waves in media, equivalence principle, duality and complementarity, Generation of electromagnetic radiation.

1. Topics to be Covered		
List of Topics	**No. of Weeks**	**Contact hours**

❖ **Boundary Value Problems:** Review of vector analysis, Reviw of the electrostatic and magnetostatic fields, including the polarisation field in dielectrics and the magnetisation field in magnetisable media; Potential theory (boundary value problems, uniqueness theorem, method of images, separation of variables) with applications in electrostatics, magnetostatics and stationary current distributions.	**4**	**12**
❖ **Maxwell's Equations and Conservation Laws:** Induction law and displacement current, Maxwell Equations, Vector and Scalar Potentials, Gauge Transformation, Lorantz Gauge, Coulombs Gauge, Green Functions for The Wave Equation, Poynting's Theorem and Conservation of Energy and Momentum for a system of Charged Particles and Electromagnetic Fields, Poynting's Theorem for Harmonic Fields, Fields Definition of Impedance and Admittance, Transformation Properties of Electromagnetic, Fields and Sources under Rotations, Spatial Reflections, and Time Reversal.	**4**	**12**
❖ **Electromagnetic Waves:** Plane Waves in a Nonconducting Isotropic Media, Polarization; Stokes Parameters; Reflection and Transmission, Total Internal Reflection; Goos–Hänchen Effect; Dispersive materials, phase/group velocities, Propagation in plasmas, conductors, dielectrics; Waves at media interfaces, Fresnel equations.	**4**	**12**
❖ **Radiating Systems:** Fields and Radiation of a Localized Oscillating Source; Electric Dipole Fields and Radiation; Magnetic Dipole and Electric Quadrupole Fields; Linear Antenna; Spherical Wave Solutions of the Scalar Wave Equation, Multipole Expansion of the Electromagnetic Fields; Properties of Multipole Fields, Energy and Angular Momentum of Multipole Radiation; Sources of Multipole Radiation; Multipole Moments.	**3**	**12**
	15 weeks	**45 hrs**

2. Course components (total contact and credit hours per semester):

	Lecture	Tutorial	Laboratory/	Practical	Other	Total

				Studio			
Contact Hours	Planned	45 hrs	45 hrs	0	0	0	90 hrs
	Actual	45 hrs	45 hrs	0	0	0	90 hrs
Credit	Planned	45 hrs	45 hrs	0	0	0	90 hrs
	Actual	45 hrs	45 hrs	0	0	0	90 hrs

3. Individual study/learning hours expected for students per week.	**8**

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	**NQF Learning Domains And Course Learning Outcomes**	**Course Teaching Strategies**	**Course Assessment Methods**
1.0	**Knowledge**		
1.1	Use Maxwell's equations in analysing the electromagnetic field due to time varying charge and current distribution.	1- Demonstrating the basic principles through lectures. 2. Discussing phenomena with illustrating pictures and diagrams 3. Lecturing method: Board, multimedia 4. Discussions 5. Brain storming 6. Start each chapter by general idea and the benefit of it.	Solve some example during the lecture. Exams: a) Quizzes (E-learning) b) Short exams (mid- term exams) c) Long exams (final)
1.2	Perceive the nature of electromagnetic wave and its propagation through different		

	media and interfaces.	7. Applying the principles to realistic physics problems.	Discussions during the lectures.
1.3	Recognize charged particle dynamics and radiation from localized time varying electromagnetic sources.	8. Show the best ways to solve the problems 9. Show the best ways to demonstrate the results. 10. Discussion with the student about the results.	Home work.
2.0	**Cognitive Skills**		
2.1	Explain the laws of physics related to semiconductors and atomic excitations.	1. Preparing main outlines for teaching 2.Following some proofs 3.Define duties for each chapter 4.Encourage the student to look for the information in different references 5.Ask the student to attend lectures for practice solving problem	1.Midterm's exam. Exams, short quizzes 2.Asking about methods previously taught 3.Discussions of how to simplify or analyze some phenomena
2.2	Analyze and explain problems in optoelectronics using suitable mathematical principles.		
2.3	Explain and interpret quantitative results.		
3.0	**Interpersonal Skills & Responsibility**		
3.1	Show responsibility for self-learning to be aware with recent developments in physics	• Search through the internet and use the library. • Small group discussion. • Enhance educational skills. • Encourage the student to attend lectures regularly. • Give students tasks of duties	• Evaluate the scientific values of solutions. • Evaluate the work in team • Evaluation of the role of each student in lab group assignment • Evaluation of students presentations.
3.2	Work effectively in groups.		
4.0	**Communication, Information Technology, Numerical**		
4.1	Communicate effectively in oral and written form.	• Homework • preparing a report on some topics related to the course depending on web sites.	• Evaluation of presentations • Evaluation of reports • Practical exam • Homework. Final exams.
4.2	Collect and classify the material for a course		
4.3	Use basic physics terminology in English		
4.4	Acquire the skills to use the internet communicates tools.		
5.0	**Psychomotor(if any)**		

5.1	Not applicable		

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	**Exercises & Home works**	**All weeks**	**10%**
2	**Participation in activities during lectures**	**All weeks**	**10%**
3	**1st Periodic Exam**	**8th week**	**15%**
4	**2nd Periodic Exam**	**11th week**	**15%**
5	**Final Exam**	**16th week**	**50%**

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) Studentsare supervised by academic advisers 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-** Classical Electrodynamics Third Edition, by John David Jackson, Wiley 1998. **2-** Introduction to Electrodynamics 4th Edition, by David J. Griffiths, Cambridge University Press 2017. **3-** Classical Electromagnetic Radiation, Third Edition Third Edition, by Mark A. Heald and Jerry B. Marion, Courier Corporation 2012. **4-** Classical Electricity and Magnetism: Second Edition, by Wolfgang K. H. Panofsky and Melba Phillips, addison Wesley 2005.
2. List Essential References Materials (Journals, Reports, etc.)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
4. 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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) There are enough classrooms provided with a good accommodation, including good air condition, good Data show, and suitable white board.
2. Technology resources (AV, data show, Smart Board, software, etc.) In each class room, there is a data show projector, and board.
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching • **Course reports** • **Course evaluation.**
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • Revision of student answer paper by another staff member. • Analysis of the grades of students.
3. Procedures for Teaching Development • Preparing the course as PPT. • Coupling the theoretical part with real physics problems • Periodical revision of course content.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) • 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.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. 1- The following points may help to get the course effectiveness ▪ Student evaluation ▪ Course report ▪ Program report ▪ Program Self study According to point 1 the plan of improvement should be given.

Name of Course Instructor: _ Walid Belkacem Belhadj & Mohamed M. Sabry _____

Signature: _____ Date Completed: _____

Program Coordinator: _____

Signature: _____ Date Received: _____

Course Title: Computational Physics

Course Cod: 403606-3

(C-4)

Date: 20....-.....-.....	**Institution:** UMM AL – QURA UNIVERSITY.
College: Faculty of Applied Science.	**Department:** Department of physics.

A. Course Identification and General Information

1. Course title and code: Computational Physics (**403606**)
2. Credit hours: **3 h**.
3. Program(s) in which the course is offered. **M.Sc. 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 academic staff member**
5. Level/year at which this course is offered: **1st Year / Level 1**
6. Pre-requisites for this course (if any):
7. Co-requisites for this course (if any):
8. Location if not on main campus: **Main campus**
9. Mode of Instruction (mark all that apply): a. Traditional classroom ☑ percentage? 80% b. Blended (traditional and online) ☐ percentage? ☐ c. E-learning ☑ percentage? 20% d. Correspondence ☐ percentage? ☐ f. Other ☐ percentage? ☐
Comments:

B Objectives

1. The main objective of this course The aim of the course is show how the power of computers to solve physics problems, which is distinct from, traditional theoretical approaches. The material covered will be useful in any project or problem solving work that contains a strong computational or data analysis element. The course is designed such that a significant fraction of the student's time is spent actually programming specific physical problems rather than learning abstract techniques.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field). -The most recent versions of Matlab software. -Personal counselling for issues affecting study. -Academic Support with Mathematics.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description: This course is designed to provides an introduction to computational methods in physical science. It teaches (using calculus software) programming tactics, numerical methods and their implementation, together with methods of linear algebra. These computational methods are applied to problems in physics, including the modelling of classical physical systems to quantum systems, as well as to data analysis such as linear and nonlinear fits to data sets.

1. Topics to be Covered		
List of Topics	**No. of Weeks**	**Contact hours**
-Programming: Variables and arrays. Displaying output data, Data files, scalar and array operations, Built in functions. , the while Loop, the FOR Loop. Preserving data between calls to a function, subroutines.	2	6
-Linear Algebra: Solving a linear system, Gaussian elimination . 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
-Modelling: Harmonic motion example using a variety of numerical approaches.	2	3
-Modelling: The Solar system: Kepler's laws, planetary motion using different time steps, Orbits using different force laws. The three body problem and the effect of Jupiter on Earth.	1	**3**
Modelling: Potentials and Fields: Solution of Laplace's equation using the Jacobi relaxation method. Solutions of Laplace's Equation for a finite sized capacitor. Potentials and Fields near Electric Charges, Poisson Equation.	2	**3**
-Modelling: Waves: Waves on a string. Waves on a string with free ends. Frequency spectrum of waves on a string.	2	**3**
Modelling: Monte-Carlo. Random Walk simulation. Markov-Chain techniques for simulating the Ising spin model in statistical mechanics.	2	**3**
-Modelling: -Quantum Mechanics: Time independent Schrodinger Equation. Wave packet construction. Time dependent Schrodinger Equation.	1	**3**
	15 weeks	**45 hrs.**

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	45 hrs		45 hrs			90 hrs
	Actual	45 hrs		45 hrs			90 hrs
Credit	Planned	45 hrs		45 hrs			90 hrs
	Actual	45 hrs		45 hrs			90 hrs

3. Individual study/learning hours expected for students per week. 8 hrs.

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
	Upon successful completion of this course. The student will be able to:		
1.1	Familiar with strings and matrices and their use.	-Demonstrating the basic information and principles through lectures -Discussing statements with illustrating pictures and diagrams.	-Assignments -Projects -Online quizzes -Written Exams
1.2	Demonstrate knowledge in essential methods and techniques for numerical computation in physics.		
1.3	Employ appropriate numerical method to interpolate and extrapolate data.		
1.4	Use appropriate numerical method to solve differential equations		
2.0	**Cognitive Skills**		
	Having successfully completed the course students should be able to:		
2.1	Able to use Matlab for interactive computations.	-Demonstrating the basic information and principles through lectures -Discussing statements with illustrating pictures and diagrams.	-Assignments -Projects -Online quizzes -Written Exams
2.2	Able to generate plots and export this for use in reports and presentations.		
2.3	Able to program scripts and functions using the Matlab development environment.		
2.4	Able to use basic flow controls (if-else, for, while).		

2.5	Apply Monte Carlo method to solve deterministic as well as probabilistic physical problems		
3.0	**Interpersonal Skills & Responsibility**		
3.1	To learn how to incorporate modern computation and visualization into scientific problem.	-Lab work. -Case Study. -Small group discussion.	-Evaluate the scientific values of solving specific physical problem. -Evaluate the work in team -Evaluation of the role of each student in lab group assignment
3.2	To provide a framework and motivation to learn compiled language.		
3.3	Participate in learning activities and complete tasks on time.		
4.0	**Communication, Information Technology, Numerical**		
4.1	To understand how their graduate research will be advanced by the use of modern scientific computing skills and tools.	-Small group discussion.	Small Project
5.0	**Psychomotor(if any)**		
5.1	Not applicable.	Not applicable.	Not applicable.

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Exercises & Home works	All weeks	5%
2	Online quizzes	All weeks	5%
3	Oral exam	5th Week	5%
4	Participation in activities lectures and labs	All weeks	5%
5	Test (1)	6th week	10%
6	Test (2)	13th week	10%
7	Scientific project	14th Week	10 %
8	Final Exam	16th week	50%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) Each student will be supervised by an academic adviser and the time table will be given to the student each semester.

E Learning Resources

1. List Required Textbooks -"Mastering Matlab 7" by Duane C. Hanselman and Bruce L. Littlefield, Prentice Hall, ISBN-13: 978-0136013303 (2011). -"Computational Physics using Matlab" Second Edition, by Nick Giordano and Hisao Nakanishi, ISBN: 0-13-146990-8 (2005). -"Introduction To Computational Physics Using Matlab", Khusniddin K. Olimov, Erkin Kh. Bozorov , (2017). -"Computational Physics (2nd Edition)" Nicholas J. Giordano, Hisao Nakanishi, ISBN-13: 978-0131469907 (2005).
2. List Essential References Materials (Journals, Reports, etc.) -"Mathematics for Physics: An Illustrated Handbook (Computational Mathematical and) 1st Edition, Kindle Edition" ISBN-13: 978-9813233911 (2017). -"Computational Physics 2nd Edition", Jos Thijssen, ISBN-13: 978-1107677135 (2013)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
4. 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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) Computer room.
2. Technology resources (AV, data show, Smart Board, software, etc.)
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching • Questionnaires • Open discussion in the computer room.

2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • Revision of student answer paper by another staff member. • Analysis the grades of students.
3. Procedures for Teaching Development • Course report.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution)
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. • Periodical revision by Quality Assurance Units in the Department and institution

Name of Course Instructor: **Khaled Abdel-Waged**

Signature: _____ **Date Completed:** _____

Program Coordinator: **Khaled Abdel-Waged**

Signature: _____ **Date Received:** _____

Course Title: Research methodology

Course Code: 403614-3

(C-5)

Date: 5-10-2018.	**Institution:** UMM AL– QURA UNIVERSITY
College: : Faculty of Applied Science	**Department:** Physics Department

A. Course Identification and General Information

1. Course title and code: **Research methodology - 403614-3**
2. Credit hours: **3 hrs Lectures**
3. Program(s) in which the course is offered. : **M.Sc in 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 academic staff member**
5. Level/year at which this course is offered: **2nd Year / Level 3**
6. Pre-requisites for this course (if any): Academic guide
7. Co-requisites for this course (if any):
8. Location if not on main campus: **Main campus and Al-Zaher Branch**
9. Mode of Instruction (mark all that apply): a. Traditional classroom [√] percentage? [100%] b. Blended (traditional and online) [ ] percentage? [ ] c. E-learning [ ] percentage? [ ] d. Correspondence [ ] percentage? [ ] f. Other [ ] percentage? [ ] Comments: A Preliminary report on the research project (2000 words) is graded in this course.

B Objectives

1.The main objective of this course: The overall goal is to write in a traditional format, which is also referred to as the **IMRaD** format (**I**ntroduction, **M**aterials and methods, **R**esults, **a**nd **D**iscussion) that cites and uses appropriate literature, analyzes and displays data, demonstrates writing in a science style, and makes reasoned conclusions.

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

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description: This course provides a comprehensive introduction to research proposal writing, research methodologies, and foundational research theories and protocols. Students in the course learn about the cyclical nature of applied research and the iterative process of research writing (Periodical, dissertation, thesis, posters, ...etc). The course teaches students how to write a proposal, helping students to identify a study topic, organize a literature review, and select appropriate research designs and methodologies. This course, also, is designed to develop the ability to use the Internet to do legitimate research and to teach the methods for locating and evaluating sources and the creation of effective search strategies.

1. Topics to be Covered		
List of Topics	**No. of Weeks**	**Contact hours**
Course overview and introduction to the Study: Introduction (why the study was selected, background and setting), Statement of Problem, Purpose of the Study, Importance of the Study, Definition of Terms (if needed)	1	3
Review of Related Literature: This chapter should contain a concise presentation of literature and research (periodicals, dissertation abstracts, books, etc.) relevant to the problem.	2	6
Developing a bibliography and properly citing sources within text Online Reading: Citing Sources	2	6

SCIENCE GRAPHICS: Discussion and illustration of the importance of clear graphical presentation of data. Review basic guidelines and critically examine good and bad examples from the literature. Producing effective and publishable figures using a suitable software	2	6
WRITING AN IMRaD MANUSCRIPT: INTRODUCTION & METHODS. Review the functions, writing style, and content of Introduction and Methods sections.	2	6
Research Presentations: - Making scientific posters; Detailed instructions will be given on the design and development of a poster in class. - Making scientific papers; Detailed instructions will be given on the design and development of a paper in class. - students will present material to the class.	2	6
Library Research & Resources Practice (class in the library): Organization of Knowledge: Metadata and searching for information Online Reading: Library Catalog, Keyword Searching, and Subject Searching.	2	6
Evaluating Web Sites Online Reading: Evaluate Web Sites (reliable website with information related to your research topic.). Information ethics: Copyright, plagiarism Online Reading: Plagiarism	2	6
Total number	15 hrs	45 hrs

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	45 hrs			45 hrs		90 hrs
	Actual	45 hrs			45 hrs		90 hrs
Credit	Planned	45 hrs			45 hrs		90 hrs
	Actual	45 hrs			45 hrs		90 hrs

3. Individual study/learning hours expected for students per week. 8

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
	Upon successful completion of this course the student will be able to:		
1.1	-Develop a greater understanding of scientific processes	-a summary of existing research on the subject. - explain what we know, and what we are uncertain about - explain and summarize, -ask questions, clarify, compare..etc.	-Oral presentation -Reports
1.2	-Research a given topic and select appropriate websites		
1.3	-Accurately collect, analyze and report data		
1.4	-Create and present a proposal for their senior thesis research		
2.0	**Cognitive Skills**		
	Having successfully completed the course students should be able to:		
2.2	use a web browser to navigate the Internet to find relevant and useful web materials with appropriate search engines.	-Applying valid and reliable methods. -Present the findings -Organize, classify and analyze	-Oral presentation -Reports
2.3	-identify and select keywords and search terms that represent an information need or research question.		
2.4	-write an IMRaD manuscript that cites and uses appropriate literature.		

2.5	-write an **IMaAD** manuscript that analyzes and displays data.	-Explain and interpret differences between various studies -Assess and evaluate. -Make comparisons with other studies. -Make recommendations - draw any conclusions with a summing up	
2.6	-write an **IMaAD** manuscript that demonstrates writing in a science style.		
2.7	-write an **IMRaD** manuscript that makes reasoned conclusions.		
3.0	**Interpersonal Skills & Responsibility**		
	At the end of the course, the student will be able to:		
3.2	Access and use information ethically and legally		
4.0	**Communication, Information Technology, Numerical**		
	Description of the skills to be developed in this domain. At the end of the course, the student will be able to:		
4.2	-improve scientific thinking skills		
5.0	**Psychomotor(if any)**		
5.1	Not applicable		

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Oral presentation (1)	6th week	10%
2	First Report (1)	6th week	15%
3	Oral presentation (2)	10th week	10%
4	Second Report (2)	10th week	15%
5	Scientific project report related to thesis	14th Week	50 %
	Total		100%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per 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.

E Learning Resources

1. List Required Textbooks 1- John W. Creswell , J. David Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, SAGE Publications, Inc; Fifth Edition (2018) ISBN-13: 978-1506386706 2- Ron Iphofen, Martin Tolich Handbook of Qualitative Research. Sage, (2018) ISBN-13: 978-1473970977 3- Contemporary Field Research: Perspectives and Formulations. Prospect Heights, IL: Waveland Press (2001) ISBN-13: 978-1577661856 4- William Strunk Jr., Virginia Campbell , "The Elements of Style: Simplified and Illustrated for Busy People" (2018) ISBN-13: 978-1980205197. 5- William Badke, Research Strategies:6th edition (2018) ISBN-13: 978-1532018039
2. List Essential References Materials (Journals, Reports, etc.)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. (http://www3.selu.edu/adunnington/LS102/.)
4. 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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) • Class room is already provided with data show • Computer Lab provided with data show • The area of class room is suitable concerning the number of enrolled students and air conditioned. • King Abdulah Library (Umm Al-Qura University)
2. Technology resources (AV, data show, Smart Board, software, etc.) • Computer room.
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching • Questionaries' using the e-learning gate of Umm Al-Qura university • Open discussion in the class room using the e-learning gate of Umm Al-Qura university.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • Revision of student answers by another staff member.
3. Procedures for Teaching Development • Preparing the course as PPT. • Using the e-learning gate of umm Alqura university • Using scientific movies.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) • After the agreement of Department and Faculty administrations
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. • Periodical revision by Quality Assurance Units in the Department and institution

Name of Course Instructor: Badie

Signature: _____ **Date Completed:** _____

Program Coordinator: Khaled Abdel-Waged

Signature: _____ **Date Received:** _____

Elective Courses

Course Title: Advanced programming

Course Code: 403610-3

(E-1)

Date: 5.-10-2018	**Institution: UMM AL– QURA UNIVERSITY**
College: Faculty of Applied Science	**Department: Department of Physics**

A. Course Identification and General Information

1. Course title and code: **Advanced programming (403610-3)**
2. Credit hours: **3 hrs**
3. Program(s) in which the course is offered. **MSc in 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 academic staff member**
5. Level/year at which this course is offered: **2nd Year / Level 3**
6. Pre-requisites for this course (if any): **Academic guide**
7. Co-requisites for this course (if any):
8. Location if not on main campus: **Main campus and Al-Zaher Branch**
9. Mode of Instruction (mark all that apply): a. Traditional classroom ✓ percentage? 80% b. Blended (traditional and online) ☐ percentage? ☐ c. E-learning ✓ percentage? 20% d. Correspondence ☐ percentage? ☐ f. Other ☐ percentage? ☐
Comments:

B Objectives

1. The main objective of this course **After completing this course student should be able to:** 1. Grasp the idea of Object oriented Programming 2. Learn how to create Classes. 3. Write Programs in C++.

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

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description: Object oriented programming (OOP) is becoming more and more important, and this course will address this. OOP offers a new and powerful way to cope with complexity. In this course, the student will learn how to write a program as a group of objects that have certain properties and can take certain actions, instead of viewing a program as a series of steps to be carried out. At the end of the course, the programs that the student shall write will be clearer, more reliable and easy to maintain. C++ is quite similar to other languages with two or three grand ideas thrown in. These new ideas are fascinating in themselves and they are becoming part of the programming culture. In particular, the student will learn C++ algorithms and will enable to perform - Write Object Oriented Programming. - Use Pointers and Classes. - Solve real Programming problems.

1. Topics to be Covered		
List of Topics	**No. of Weeks**	**Contact hours**
Basics- Program construction, Output using "cout", Header files, when to use comments, Integer variables, variable names, integer constants the "endl" manipulator, exercises.	1	3
Basics- Character variables, character constants, escape sequence, input with "cin", floating point type, type bool, "setw" manipulator, the "iomanip" header file, arithmetic operation, library functions, exercises.	1	3
Loops and decisions – Relational operators, Loops, the "for" loop, the "while" loop, the "do" loop, Decisions, the "if" statement, the "if else" statement, the "switch" statement, the conditional operator	1	3
Loops and decisions- Logical operators, logical "AND" operator, logical "OR" operator, logical "Not" operator, the "break" statement, the "continue" statement, exercises	1	3

Structures- A simple structure, Defining the structure, accessing structure members, Structure within Structures, Structures and Classes, Enumeration, examples, exercises	1	3
Functions- Simple functions, the function declaration, calling the function, the function definition, passing arguments to functions, passing constants, passing variables, passing by value, Returning values from functions, the return statement, Returning structure variables	1	3
Functions- Reference arguments, Passing Data types by reference, Passing more complex pass by Reference, Passing Structures by Reference, Overloaded functions, inline functions, Returning by References.	1	3
Objects and Classes- A simple class, classes and objects, defining the class, using the class, calling member functions	1	3
Objects and Classes- Constructors, Destructors, objects as function arguments, overloaded constructors, Member functions defined outside the class, Static class data, const and classes.	1	3
Arrays- Array fundamentals, arrays as class member data, arrays of objects and exercises	1	3
Pointers– Addresses and pointers, Pointers and arrays, examples	1	3
Pointers- Pointers and functions, the “new” and “delete” operators examples.	1	3
Inheritance- Derived class and base class, Derived class constructors, class inheritance, Public and private inheritance.	1	3
Virtual functions- Normal member functions accessed with pointers, virtual member functions accesses with pointers, friend functions, static functions, examples	2	6
Total number	15	45

2. Course components (total contact and credit hours per semester):

		Lecture	**Tutorial**	**Laboratory/ Studio**	**Practical**	**Other**	**Total**
Contact Hours	Planned	45 hrs			45 hrs		90 hrs
	Actual	45 hrs			45 hrs		90 hrs
Credit	Planned	45 hrs			45 hrs		90 hrs

	Actual	45 hrs			45 hrs		90 hrs

3. Individual study/learning hours expected for students per week.	8

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	**NQF Learning Domains And Course Learning Outcomes**	**Course Teaching Strategies**	**Course Assessment Methods**
1.0	**Knowledge**		
	Upon successful completion of this course. The student will be able to:	-Demonstrating the basic information and principles through lectures and the achieved applications. -Discussing C++ statements with illustrating pictures and diagrams	- Online quizzes -Midterm's exam. -Assignments
1.1	-learn the syntax of the C++ programming language.		
1.2	-understand the concept of arrays.		
1.3	-apply fundamental syntax rules for identifiers, declarations, expressions, statements, and functions		
1.4	-understand the concept of pointers and dynamic memory allocation.		
1.5	-apply techniques of structured (functional) decomposition to decompose problem.		
1.6	-create and call functions that use parameter passing and return values.		
1.7	-learn how to design C++ classes		

1.8	-learn how to handle private and protected members of a class		
1.9	-understand the concept of data abstraction and encapsulation		
1.10	-learn how to overload functions and operators in C++		
1.11	-learn how inheritance and virtual functions work.		
1.12	-learn how to design and implement generic classes with C++ templates.		
2.0	**Cognitive Skills**		
	Having successfully completed the course students should be able to:		.
2.1	-explain how an existing C++ program works	-Demonstrating the basic information and principles through lectures and the achieved applications. -Discussing C++ statements with illustrating pictures and diagrams	- Online quizzes -Midterm's exam -Assignments
2.2	-discover errors in a C++ program and describe how to fix them		
2.3	-critique a C++ program and describe ways to improve it		
2.4	-analyze a problem and construct a C++ program that solves it.		
2.5	-modify and extend short programs that use standard conditional and iterative control structures and functions		
2.6	-choose and apply the required Linux commands to develop C++ programs in a command-line environment		
3.0	**Interpersonal Skills & Responsibility**		
3.1	**At the end of the course, the student will be able to:** Do calculations independently. Make programs in a form of classes.	-Extensive use of C++ library. -Lab work. -Case Study. -Small group discussion.	-Evaluate the efforts of each student by online quizzes. -Evaluate the scientific values of solving specific physical problem. -Evaluate the work in team

		-Learn independently and take up responsibility. -Develop their interest in programming. -Give students tasks of duties	-Evaluation of the role of each student in lab group assignment
3.2			
4.0	**Communication, Information Technology, Numerical**		
4.1	**At the end of the course, the student will be able to:** -Enhance the ability of students to use computers and internet. -Computation -Problem solving -Data analysis and interpretation. Feeling physical reality of results	Small project	-Evaluation of presentations -Evaluation of reports Practical exam -Online quizzes -Research.
5.0	**Psychomotor(if any)**		
5.1	Not applicable		

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Exercises & Home works	All weeks	5%
2	Online quizzes	All weeks	5%
3	Oral exam	5th Week	5%
4	Participation in activities lectures and labs	All weeks	5%
5	Test (1)	6th week	10%
6	Test (2)	13th week	10%
7	Scientific project	14th Week	10 %
8	Final Exam	15th week	50%
	Total		100%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) Each student will be supervised by an academic adviser and the time table will be given to the student each semester.

E Learning Resources

1. List Required Textbooks 1- Object oriented programming in C++, Robert Lafore, fourth edition, Pearson and Sam Publishing (2002), ISBN 0-672-32308-7. 2- Object oriented programming using C++, Joyce Farrel, fourth edition, 2009, ISBN-13: 978-1-4239-0257-7. 3- Bjarne Stroustrup, The C++ Programming Language, 4th Edition (2013), ISBN-13: 978-0321563842. 4- -"Applied Computational Physics 1st Edition" Joseph F. Boudreau, Eric S. Swanson ISBN-13: 978-0198708643 (2018).
2. List Essential References Materials (Journals, Reports, etc.) -Siddhartha Rao, "C++ in One Hour a Day, Sams Teach Yourself (8th Edition)", (2016) ISBN-13: 978-0789757746. -Bjarne Stroustrup, "A Tour of C++ (C++ In-Depth Series)" , (2018), ISBN-13: 978-0134997834.
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. (eg. www.youtube.com.)
4. 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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) • Class room is already provided with data show • Computer Lab provided with data show • The area of class room is suitable concerning the number of enrolled students and air conditioned. • King Abdulah Library (Umm Al-Qura University)
2. Technology resources (AV, data show, Smart Board, software, etc.) • Computer room. • C++ software.

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching • Questionaries using the e-learning gate of Umm Al-Qura university • Open discussion in the class room using the e-learning gate of Umm Al-Qura university.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • Revision of student answers by another staff member. Analysis the grades of students using the e-learning gate of Umm Al-Qura University..
3. Procedures for Teaching Development • Preparing the course as PPT. • Using the e-learning gate of umm Alqura university • Using scientific movies. • Coupling the theoretical part with laboratory part • Periodical revision of course content.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) • After the agreement of Department and Faculty administrations
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. Periodical revision by Quality Assurance Units in the Department and institution

Name of Course Instructor: Badie

Signature: _____ Date Completed: _____

Program Coordinator: Khaled Abdel-Waged

Signature: _____ Date Received: _____

Course Title: Advanced Research lab.

Course Code: **403626-3.**

(E-2)

Date: 20....-.....-.....	**Institution:** UMM AL – QURA UNIVERSITY.
College: **Faculty of Applied Science**.	**Department:** **Department of physics**.

A. Course Identification and General Information

1. Course title and code: advanced Research lab. **403626-3**			
2. Credit hours: 3 hrs.			
3. Program(s) in which the course is offered. **M.Sc. 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 academic staff member**			
5. Level/year at which this course is offered: **2nd Year / Level 3**			
6. Pre-requisites for this course (if any): **Solid State Physics 403631**			
7. Co-requisites for this course (if any):			
8. Location if not on main campus: **Main campus**			
9. Mode of Instruction (mark all that apply):			
a. Traditional classroom	✓	percentage?	30
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other	✓	percentage?	70
Comments:			

B Objectives

1. The main objective of this course Students in this laboratory will learn experimental techniques, data, collection, data handling, and data interpretation and analysis. This course consists of two parts: a laboratory for preparation any material (nano materials, thin films, polymer films, metals, glass and ceramics and laboratory characterization of these materials. During the semester, students will work in alone or group to complete experimental to make individual reporting. To enable the student to understand various device characterization techniques.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field). This course and its contents are designed to obey most current learning experimental arising from learning and cognitive sciences as well as the teaching strategy outlined in this course. Any development will be made by qualified faculty members that teaching this course based on their assessment of the skills and needs of their students and the techniques.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description: Materials science lab. is concerned with preparation, processing, structure, and properties of polymers, and thin film materials. Work experience that combines the theoretical in the tutorial room and the practical knowledge of materials manufacturing to provide students with the background of professional knowledge.

1. Topics to be Covered		
List of Topics	**No. of Weeks**	**Contact hours**
Introduction of material science laboratory.	1	3
Preparation of nanomaterial by chemical method and Preparation of nanomaterial by ball milling method and measurement it by UV-visible spectroscopy.	3	9
Preparation of thin films by spin coating and study their electrical conductivity by temperature-four probe method	2	6

Preparation of biopolymer material and study the morphology and crystal growth rate by polarized optical microscopy (POM).	2	6
Determination of the elongation at break and Young's modulus of polymer film by Tensile test.	1	3
Determination of dielectric constant, dielectric loss and Electrical conductivity of some material by impedance analyzers.	2	6
Preparation of thin film by vacuum thermal evaporation of and study the morphology by SEM.	1	3
Study of crystal size by using XRD and the cell Scherrer formula for some crystalline material.	1	3
Study the Surface morphology for some material by atomic force microscopy (AFM).	1	3
Study the I-V characteristics for solar cell temperature-two probe method	1	3
	15 weeks	**45 hrs.**

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned		----------	14	14	-------	14
	Actual						
Credit	Planned		--------	3	3		3
	Actual						

3. Individual study/learning hours expected for students per week. 3h.

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

- ✓ To introduce the characteristics of Nanoscale fabrication thin films and polymer material techniques.

- ✓ The students are trained in electrical methods, optical methods, tensile testing methods, XRD methods, POM, SEM and AFM.
- ✓ To make the students understand the principle involved in preparation and characterization of materials. To teach the principle and fabrication of materials.
- ✓ At the end of the course, the students will be able to understand the various techniques.

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Understand crystalline systems from XRD and POM.	Components of the laboratory reports require students to discuss and explain the theories of the experiment. Lecture notes Foils Blackboard Laptop presentations. Time is also included to allow for student discussions during lab time.	. The student classifies the physical properties of material in the laboratory report after examination of the material.(42%) Final exam (40%) Seminar (18%)
	Investigate of the mechanical properties of materials by Tensile tester.		
1.6	Introduce various methods available for characterizing the materials like electrical and UV-spectroscopic methods		
	Apply know-how for materials science by means of instrumental-measurement experiments		
	Investigation the surface morphology by SEM and AFM.		
2.0	**Cognitive Skills**		
	Writing understandable and detailed lab reports	Laboratory lab manual for all experiments that encourage students to think about scientific research and in the future produce new materials that reflect the needs of the industry. A testing framework is to identify unknown material or	Laboratory reports require students to use these skills to successfully complete reports and these skills are assessed.
	Data analysis		
	data interpretation and graphical Representation		
	Working in a team with different backgrounds		

		new material, collect data about the material to solve the problem,	
3.0	**Interpersonal Skills & Responsibility**		
3.1	Cooperation and collective participation, patience during the experiment, professional development and independent learning.		
4.0	**Communication, Information Technology, Numerical**		
4.1	Oral and written communication, word processing and information retrieval.	.	.
5.0	**Psychomotor(if any)**		
5.1	Not applicable.	Not applicable.	Not applicable.

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	During the examination period following the module, an oral exam (duration: 30 min.) on “certain experimental” is held.	14th week	20 %
2	Experimental reports	Each week	40 %
3	Final exam	15th week	40%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week)

E Learning Resources

1. List Required Textbooks

During the lab course, a set of references is given for each experiment. Manuals are available for all experiments; they contain individual literature references for all experiments.

2. List Essential References Materials (Journals, Reports, etc.)

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

.Electronic Materials, Web Sites etc.

4. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

measurement equipment. Lecture notes Foils Blackboard Laptop presentations.

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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) Lab. room , tools and a board to write and explain the experimental.
2. Technology resources (AV, data show, Smart Board, software, etc.) Computer Lab..

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching • Questionnaires • Open discussion in the lab room at the end of the experimental.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • Revision of student answer paper by another staff member. • Analysis the grades of students.
3. Procedures for Teaching Development • Course report. • Program report and Program self-study and a Lab. Room.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. • Periodical revision by Quality Assurance Units in the Department and institution

Name of Course Instructor: Ahmed El-Hadi

Signature: _____ Date Completed: _____

Program Coordinator: Adel-Madani

Signature: _____ Date Received: _____

Course Title: **Semiconductor device modeling**

Course Code: **403620**-3

(E-3)

Date: 27/9/2018	**Institution:** Umm AL – Qura University
College: College of Applied Science	**Department:** Department of Physics

A. Course Identification and General Information

1. Course title and code: **Semiconductor device modeling (code: 403620)**			
2. Credit hours: **3Hrs**			
3. Program(s) in which the course is offered. **Master of Physics;** (If general elective available in many programs indicate this rather than list programs)			
4. Name of faculty member responsible for the course: **Walid Belkacem Belhadj**			
5. Level/year at which this course is offered: **2nd Year / Level 3**			
6. Pre-requisites for this course (if any): **Academic guide**			
7. Co-requisites for this course (if any):			
8. Location if not on main campus: **Main campus and Alzaher**			
9. Mode of Instruction (mark all that apply):			
a. traditional classroom	✓	What percentage?	90
b. blended (traditional and online)		What percentage?	
c. e-learning	✓	What percentage?	10
d. correspondence		What percentage?	
f. other		What percentage?	
Comments:			

B Objectives

1. The main objective of this course The course provides students with deep theoretical background, as well as a broad knowledge about the benefits and different applications for numerical simulation of semiconductor devices. By implementing simulating codes, students will learn the fundamental structures (physical models and numerical techniques) for macroscopic (drift-diffusion) as well as microscopic (Monte Carlo) simulation of semiconductor devices and materials. Students will also learn how to use Computer Aided design (CAD) tools for semiconductor device design.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field): 1- Collaborate with other educational institutions to reveal how they deal with the subject. 2- Renew and update the course references periodically. 3- Frequently check the latest discovery in science to improve the course objectives. 4- Posting some course material on the websites to help the students. 5- Assigning presentations to students to improve their research skills. 6- Focusing on generic skills.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description: This course deals mainly with physical device models which are developed from the carrier transport physics and device geometry considerations. It gives an in-depth knowledge in simulation of device physics for advanced semiconductor devices for all application areas. The main topics are: physics of electron transport in semiconductor devices, Numerical methods for attaining solutions to transport equations, Introduction to Computer Aided design (CAD) tools for semiconductor device design.

1. Topics to be Covered		
List of Topics	**No. of Weeks**	**Contact hours**

❖ **Semiconductor Carrier Transport Equations:** Semiconductor bandstructure, Simplified bandstructure models, Carrier dynamics, Semiconductor effective mass, Semiclassical transport theory, Boltzmann transport equation, Maxwell's equations, Drift-Diffusion Transport Model, equations, Boundary conditions, Generation-recombination, Scattering processes, Relaxation time approximation, Thermal Conductivity and Heat flow.	**3**	**9**
❖ **Analytical modeling and analysis of semiconductor Devices:** Techniques for solving Semiconductor equations, closed – form analysis, Mobility modeling, Analysis of pn Junction Diode, Analysis of Field Effect Transistor operation, , Analysis of MOSFET operation, limitation of the closed – form analysis.	**2**	**6**
❖ **Numerical solution of the Semiconductor equations:** Finite-Difference Schemes: Discretization of Semiconductor equations, methods for solving finite difference equations, Boundary Conditions, Simulation examples. Finite Element Method: Galerkin Method, Derivation of the Finite Element equations, Simulation examples. Modeling Heterojunction Devices: Semiconductor equations for Heterojunction, High Electron Mobility Transistors, Analytical solutions, Numerical Models, Heterojunction Bipolar Transistors, and Monte Carlo Simulations.	**4**	**12**
❖ **Monte Carlo Method:** Modeling carrier transport in Semiconductors, Equations of motion, Energy band structure, Application Monte Carlo Method for transport Characteristics and device modeling.	**2**	**6**
❖ **Introduction to Quantum transport theory:** Quantum theoretical foundations, state vectors, Schroedinger and Heisenberg picture, Band structure, Bloch theorem, one dimensional periodic potential, density of states, Pseudopotential theory, crystal symmetries, reciprocal lattice, Brillouin zone, Semiclassical transport theory, Quantum Transport Theory, limits of semiclassical transport theory, quantum mechanical derivation Boltzmann transport equation, Markov-Limes.	**4**	**12**
	15 weeks	**45 hrs**

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact	Planned	**30**	**15**	**0**	**0**	**0**	**45**

Hours	Actual	30	15	0	0	0	45
Credit	Planned	2	1	0	0	0	3
	Actual	2	1	0	0	0	3

3. Individual study/learning hours expected for students per week.	**6**

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Write the fundamental equations of determining the device current based on each of the following: Schrodinger equation, Newton's second law and Boltzmann Transport Equation (BTE).	**1.** Lectures. **2.** Discussions **3.** Slides and computer simulation software may be used by the teachers to clarify concepts. **4.** Problems solving **5.** Students may be asked to solve problems and to write simple programs in MATLAB language.	**1-** Home work assignments. **2-** Group Project assignment. **3-** Question – answer session in class. **4-** Exams: quizzes, Mid-term and final exams
1.2	Outline Analytical and numerical Techniques for solving Semiconductor transport equations.		
1.3	Describe the charge distribution in the pn diode and the MOS transistor for different bias voltages		
1.4	Describe why the electrical conductivity is different for different materials.		
1.5	Recognize how the electrical conductivity varies with temperature, light and doping		

	concentration for the semiconductors Si and GaAs.		
1.6	Describe the advantages and disadvantages as well as the limitations of each studied numerical method.		
2.0	**Cognitive Skills**		
2.1	Analytical and numerical Techniques for solving Semiconductor transport equations.	**1.** Lectures. **2.** Discussions. **3.** Problems solving. **4.** Encourage the student to look for the information in different references. **5.** Ask the student to attend lectures for practice solving problem.	**1-** Home work assignments. **2-** Group Project assignment. **3-** Question – answer session in class. **4-** Exams: quizzes, Mid-term and final exams
2.2	Criticize the strengths and limitations of numerical simulations.		
2.3	Differentiate between analytical and numerical modeling techniques.		
2.4	Implement a one-dimensional drift-diffusion simulator to obtain the potential and carrier distributions in a pn-diode.		
2.5	Develop and Implement a one-particle Monte Carlo simulator to analyze the velocity and energy distributions vs. external electric field in compound semiconductor materials.		
2.6	Calculate the current in the pn diode, the MOS transistor and the bipolar transistor using simplified device models based on the physical phenomena that influence the current.		
2.7	Analyze how different physical phenomena influence the current in semiconductor devices		
3.0	**Interpersonal Skills & Responsibility**		
3.1	Show responsibility for self-learning to be aware with recent developments in physics	**1.** Ask the students to search the internet and use the library.	**1.** Evaluate the scientific values of solutions. **2.** Evaluate the work in team

3.2	Ability to choose the best numerical method to simulate a given semiconductor device and so can analyse a transport problem by using suitable numerical method.	**2.** Encourage them how to attend lectures regularly by assigning marks for attendance. **3.** Small group discussion. **4.** Give students tasks of duties	**3.** Evaluation of the role of each student in group Project assignment **4.** Evaluation of student's presentations. **5.** Direct contact during office hours.
3.3	Work effectively both individually and in teams.		
3.4	Communicate effectively with peers.		
3.4	Illustrate the interrelationships among numerical design, technology, and global society, and of the societal implications of new developments in science.	**1.** Discussion in class	**1.** Direct contact during office hours.
4.0	**Communication, Information Technology, Numerical**		
4.1	Demonstrating capability in performing research as well as an effective oral and written communication.	**1.** Communicate effectively in writing, orally and through scientific diagrams. **2.** Preparing a report on some topics related to the course depending on web sites.	1. Evaluation of presentations 2. Evaluation of reports & Project assignment.
4.2	Acquire a working knowledge of basic research methodologies, data analysis and interpretation.	**1.** Independent study. **2.** Problem solving.	**1.** Homework **2.** Assignments.
4.3	Demonstrate effective written and oral communication skills, especially the ability to transmit complex technical information in a clear and concise manner.	**1.** Oral Presentations. **2.** Problem solving.	**1.** Homework. **2.** Assignments.
4.4	Use of the internet to research solution for relevant scientific problems.	**1.** Independent study.	**1.** Performance in problem solving. **2.** Assignments
4.5	Demonstrate enough knowledge in evaluating published works.	**1.** Independent study.	**1.** Performance in problem solving. **2.** Assignments.
5.0	**Psychomotor(if any)**		

5.1	N/A	N/A	N/A
5.2			

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Exercises & Home works	At the end of each chapter	10%
2	Participation in activities during lectures	All weeks	10%
3	Practical group projects	At the end of each chapter	10%
4	1st Periodic Exam	8th week	10%
5	2nd Periodic Exam	11th week	10%
6	Final Exam	16th week	50%
7			

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week)

Students are supervised by academic advisers in physics Department and the time tables for academic advices were given to the student each semester. (8hrs per week).

E Learning Resources

1. List Required Textbooks

- D. Vasileska, S. M. Goodnick, G. Klimeck, “Computational Electronics: Semiclassical and Quantum Device Modeling and Simulation 1st Edition”, CRC Press, 2010.
- C. Snowden, “Introduction to Semiconductor Device Modeling”, World Scientific, 1998.
- Fundamentals of Carrier Transport 2nd Edition, Cambridge University Press (2000).
- Carlo Jacoboni and Paolo Lugli, "The Monte Carlo Method for Semiconductor Device Simulation", Springer, 2002.

2. List Essential References Materials (Journals, Reports, etc.)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
4. 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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) Lecture room with 25 seats, equipped with a Smart Board, projector, computers and internet connection.
2. Technology resources (AV, data show, Smart Board, software, etc.) **1.** Data Show. **2.** AV Presentations. **3.** Matlab software
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) NA

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching **1.** Discussions on coverage, preferred activity, approach. **2.** Student course evaluation at the end of the course.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • Revision of student answer paper by another staff member. • Analysis of the grades of students. • Periodic self- assessment of the program. • Departmental council meetings.
3. Procedures for Teaching Development **1.** Sharing teaching experience during the department meetings. **2.** Constant update with the best teaching practices in case methodology. **3.** Attending workshop on effective teaching methods presented by experts on the teaching methodologies.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) • 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.

5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it.

The following points may help to get the course effectiveness

- Reviewing student's formal and informal feedback.
- Evaluating relevancy of the teaching methods on a regular basis.
- Discussing the results with the industry experts.
- Program Self study.

According to the above points the plan of improvement should be given.

Name of Course Instructor: _ Walid Belkacem Belhadj _____

Signature: _____ Date Completed: _____

Program Coordinator: Taha El-Fawal

Signature: _____ Date Received: _____

Nuclear Track

Course Title: Introduction to Nuclear and High Energy Physics

Course Code: 403601-3

(N-1)

Date: 20....-.....-.....	**Institution:** Um Al – Qura University
College: Science	**Department:** Physics

A. Course Identification and General Information

1. Course title and code: Introduction to Nuclear and High Energy Physics (**4036**01-3)
2. Credit hours: 3
3. Program(s) in which the course is offered: M.Sc in physics
4. Name of faculty member responsible for the course
5. Level/year at which this course is offered: 1st Year / Level 1
6. Pre-requisites for this course (if any): Quantum Mechanics (1) (B.Sc.)
7. Co-requisites for this course (if any): Non
8. Location if not on main campus: Main Campus
9. Mode of Instruction (mark all that apply):

a. Traditional classroom	☐	percentage?	90%
b. Blended (traditional and online)	☐	percentage?	10%
c. E-learning	☐	percentage?	☐
d. Correspondence	☐	percentage?	☐
f. Other	☐	percentage?	☐

Comments: 2. In this course, the student should also evaluate problems and plot graphs by a computer.

B Objectives

1. The main objective of this course

This course aims to review the key concepts in Nuclear and Particle Physics. These include fundamental nuclear properties, nuclear Binding energy, nuclear transmutation and decay, and simple nuclear models. Fundamental particles, forces, decays and conservation laws, and unification schemes are also reviewed.

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

1. Explain strategy of the course in the beginning of the semester.
2. Outlines of the Nuclear concepts, theories and the associated proofs.
3. Highlighting the day life applications whenever exist.
4. Encourage the students to see more details in the international web sites and reference books in the library.
5. Discussing some selected problems in each chapter.
6. Cooperate with different institution to find how they deal with the subject.
7. Frequently check for the latest discovery in science.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:		
1. Topics to be Covered		
List of Topics	**No. of Weeks**	**Contact hours**
1- Properties of Nuclei	2	6
1- Masses, Sizes		
2- Nuclear Spins		
3- dipole moments.		
4- Stability and instability.		
5- Nuclear Force		
2- Nuclear Models	3	9
1- Liquid Drop Model		
2- Shell Model		
3- Collective model		
3- Strong, Weak and Electromagnetic interactions at work	4	12
1- Alpha Decay		
2- Beta Decay		
3- Gamma Decay		
4-Intoduction to Elementary Particles	3	9
1- Historical introduction to elementary particles		
2- How do we produce elementary particles		
3- How do we detect elementary particles		
4- The eight fold way		

5- The Quark model		
6- The Standard model		
5- Elementary Particle Dynamics	3	9
1- The four forces		
2- Quantum Electrodynamics		
3- Decays and conservation laws		
4- Unification schemes		

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	45 hrs	45 hrs				90 hrs
	Actual	45 hrs	45 hrs				90 hrs
Credit	Planned	45 hrs	45 hrs				90 hrs
	Actual	45 hrs	45 hrs				90 hrs

2. Individual study/learning hours expected for students per week. [8]

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form 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	Explain nuclear properties. .	5. Demonstrating the basic information and principles through lectures and the achieved applications 6. Discussing phenomena with illustrating pictures and diagrams 7. Start each chapter by general idea and the benefit of it; 8. Learn the student background of the subject; 9. Show the best ways to deal with problem;	5. Solve some example during the lecture. 6. Exams: • Online Quizzes • First mid-term exam • Second Midterm exam • Oral exams • Final exams 7. Discussions with the students.
1.2	Explain the different forms of radioactivity and account for their occurrence		
1.3	Master relativistic kinematics for computations of the outcome of various reactions and decay processes		

		10. Keep the question "why" or "how" to explain always there; 11. Build a strategy to solve problem.	8. Ask the student to clear the misunderstanding of some mathematical principle. 9. Ask quality question.
2.0	**Cognitive Skills**		
2.1	Ability to describe the nuclear and particle phenomena.		
2.2	Classify elementary particles according to their quantum numbers and draw simple reaction diagrams	**8.** Preparing main outlines for teaching **9.** Following some proofs **10.** Define duties for each chapter **11.** Homework assignments **12.** Encourage the student to look for the information in different references **13.** Ask the student to attend lectures for practice solving problem **14.** Ask the student to do small research .	5. Midterm's exam. Exams, short online quizzes 6. Asking about physical laws previously taught 7. Writing reports on selected parts of the course 8. Discussions of how to simplify or analyze some phenomena
2.3	Classify different kinds of reactions between elementary particles		
2.4	Master the use of invariant mass for kinematical computations		
3.0	**Interpersonal Skills & Responsibility**		
3.1	. Demonstrate understanding and respect for scientific values like openness, precision and reliability. Be able to analyse scientific problems in general and participate in discussion about different ways to address and solve problems	6. Learn how to search the internet and use the library. 7. Learn how to cover missed lectures. 8. Learn how to summarize lectures or to collect materials of the course. 9. Learn how to solve difficulties in learning: solving problems – enhance educational skills. 10. Develop her interest in Science through :(lab work, field trips, visits to scientific and research. Encourage the student to attend lectures regularly by: ▪ Giving bonus marks for attendance ▪ Assigning marks for attendance. ▪ give students tasks of duties	6. Online Quizzes on the previous lecture 7. Creating reports 8. Discussion 9. The accuracy of the result gained by each group will indicate good group work 10. Presenting the required research on time and the degree of the quality will show the sense of responsibility.
4.0	**Communication, Information Technology, Numerical**		
4.2	Communicate scientific problems, analyses and conclusions within nuclear physics, both to specialists and the general public.		
4.3	Data analysis and interpretation.		
4.4	Feeling physical reality of results		
5.0	**Psychomotor (if any)**		

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Midterm 1	5th week	15 %
2	Midterm 2	10th week	15 %
3	Online quizzes	every week	10 %

4	Homework	Every week	5 %
5	Oral exam	Every week	5 %
6	Final exam	End of semester	50 %

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) 8 office hours per week

E Learning Resources

1. List Required Textbooks 1) A. Das and T. Ferbel, Introduction to nuclear and particle physics (second edition) World Scientific (2003) ISBN 981-238-744-7. 2) R.C. Verma & S.C. Gupta, V.K. Mittal, Introduction to nuclear and particle physics 4th Edition, Kindle Edition (2018) ISBN-13: 978-9387472617 3) Books Wagon, Basic Ideas And Concepts In Nuclear Physics: An Introductory Approach 3Rd Edition (Series In Fundamental And Applied Nuclear Physics) (2017). ISBN 0 7503-0534 7 hbk, 07503 0535 pbk. 4) Burcham, Nuclear and Particle Physics: An Introduction 2nd Edition (2009) ISBN-13: 978-0470742754. 5) Kenneth S. Krane , Introductory nuclear Physics, first edition, Jone Wily & Sons Inc. (2008) ISBN 0 - 471-80553-X . 6) Saverio D'Auria, Introduction to Nuclear and Particle Physics, Springer; 1st ed (2018) **ISBN-13:** 978-3319938547. 7) Alessandro De Angelis, Mário Pimenta, Introduction to Particle and Astroparticle Physics: Multimessenger Astronomy and its Particle Physics Foundations (2018) ISBN-13: 978-3319781808. 8) Irving Kaplan, Nuclear Physics, Narosa Publishing House (2002). **ISBN-13:** 978-8185015897 9) K. Langanke, J. A. Maruhn, Steven E. Koonin, Computational Nuclear Physics 1: Nuclear Structure (1991) ISBN-13: 978-0387535715.
2.List Essential References Materials (Journals, Reports, etc.)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. • Power points (use e-learning gate of Umm Al-Qura university) • YouTube videos (use e-learning gate of Umm Al-Qura university)

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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)

• Class room is already provided with data show • The area of class room is suitable concerning the number of enrolled students and air conditioned. • Lab with for 20 students
2. Technology resources (AV, data show, Smart Board, software, etc.) • Providing class rooms with computers and labs with data show.
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching • Questionaries' (using of e-learning gate of Umm Al-Qura university) • Online Quizzes (using of e-learning gate of Umm Al-Qura university) • Open discussion (using of e-learning gate of Umm Al-Qura university)
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • Revision of student answer paper by another staff member if evaluable Analysis the grades of students.
3. Procedures for Teaching Development • Preparing the course as PPT. • Using scientific movies. • Coupling the theoretical part with laboratory part • Periodical revision of course content.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) • After the agreement of Department and Faculty administrations • 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.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. 2- The following points may help to get the course effectiveness ▪ Student evaluation ▪ Course report ▪ Program report ▪ Program Self study ▪ E-learning

Name of Course Instructor: Walid Altaf
Signature: _____ **Date Completed:** _____

Program Coordinator: Khaled Abdel-Waged

Signature: _____**Date Received:** _____

Course Title: Nuclear Reactions

Course Code: 403605-3

(N-2)

Date: 17.10.2018.	**Institution: UMM AL - QURA UNIVERSITY.**
College: Faculty of Applied Science	**Department: Physics**

A. Course Identification and General Information

1. Course title and code: **Nuclear Reactions** **403605-3**		
2. Credit hours: **3hrs**		
3. Program(s) in which the course is offered. **M.Sc. in 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 academic staff member**		
5. Level/year at which this course is offered: **2nd Year / Level 3**		
6. Pre-requisites for this course (if any): **Introduction to nuclear and particle physics (403638-3) (M.Sc)**		
7. Co-requisites for this course (if any): --		
8. Location if not on main campus: **Main campus**		
9. Mode of Instruction (mark all that apply):		
a. Traditional classroom	√ percentage?	75
b. Blended (traditional and online)	√ percentage?	15
c. E-learning	√ percentage?	10
d. Correspondence	percentage?	
f. Other	percentage?	

Comments: 2. **In this course, the student should also evaluate problems and plot graphs by a computer.**

B Objectives

1. The main objective of this course This course, together with "Introduction to nuclear and particle physics" prepares the students with the background for research in Nuclear Physics, for instant in terms of a M.Sc. Project. In this course, focus is on nuclear reactions, fission and fusion.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field) 1. Review the course description frequently and rewrite it according to modern data. 2. Develop learning strategies to increase student understanding of physical phenomena. 3. Encourage the student to use massive open online courses (MOOCs). **4.** Increased student understanding by mentioning the applications of physical principle.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

1. Topics to be Covered **1- Chapters 11-14 of K. S. Krane, Introductory nuclear physics (see references below)**		
List of Topics	**No. of Weeks**	**Contact hours**
1. Kinematics in Nuclear Reactions: 1- Types of reactions and conservation laws 2- Energetics of nuclear reactions 3- Reaction cross sections 4- Coulomb scattering 5- Nuclear scattering 6- The Optical model 7- Direct and compound nuclear reactions **8-** Resonance and Heavy-ion reactions	**5**	**15**
2- Neutron Physics 1- Neutron sources 2- Absorption and moderation of neutrons 3- Neutron reactions and cross sections 4- Neutron capture 5- Interference and diffraction with neutrons	**4**	**12**

3-Nuclear fission 1- Characteristics of fission 2- Energy in fission 3- Fission and nuclear structure 4- Controlled Fission reactions **5-** Fission reactors	**3**	**9**
4-Nuclear fusion 1- Basic Fusion processes 2- Characteristics of fusion 3- Solar Fusion 4- Controlled Fusion reactors	**3**	**9**
Total	**15**	**45**

Lecture : 45 hrs	**Tutorial:**	**Lab:**	**Total:** 45 hrs

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	**45 hrs**	**45 hrs**				**90 hrs**
	Actual	**45 hrs**	**45 hrs**				**90 hrs**
Credit	Planned	**45 hrs**	**45 hrs**				**90 hrs**
	Actual	**45 hrs**	**45 hrs**				**90 hrs**

3. Individual study/learning hours expected for students per week. **8**

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Explain nuclear reactions	1. using the achieved applications to Demonstrating the basic information and principles 2. Discussing phenomena using pictures and diagrams. 3. Diversity in lecturing method: • e-learning	1. Exams: • Online Quizzes • mid-term exam • Oral exams • Final exams 2.Discussions with the students
1.2	Explain nuclear fission		
1.3	Explain nuclear fusion		
1.4	Explain the direct and compound nuclear reactions.		
2.0	**Cognitive Skills**		
2.1	-can write types of reactions and conservation laws. -can write energies of observable products -can express the threshold energy. -can express reaction cross section	1. Define duties for each chapter. 2. Homework assignments. 3. Encourage the student to look for the information in different references. 4. Ask the student to attend lectures and work out to solving problem.	1. Exams of various kinds 2. Writing reports on selected parts of the course. Discussions of how to simplify or analyze some phenomena.
2.2	-can write characteristics of fusion -can state activation and excitation energies -can tell basic elements of nuclear reactor		
2.3	-can state basic fusion processes -can write characteristics of fusion -can write cycles in solar fusion -can express the basic principles and laws on criterion -can write basic heating methods of plasma		
3.0	**Interpersonal Skills & Responsibility**		

	1. Ability to take responsibility and take the course instructions seriously. 2. Be able to analyze scientific problems in general and participate in discussion about different ways to address and solve problems. 3. Respect other opinions. 4. Ability to motivate and encourage others, and help a team achieve success.	1. Learn how to cover missed lectures. 2. Learn how to summarize lectures or to collect materials of the course. 3. Learn how to solve difficulties in learning: solving problems and enhance educational skills.	**1.** Discussion. **2.** The accuracy of the result gained by each group will indicate the good group work. 3. Presenting the required research on time and the degree of the quality will show the sense of responsibility.
4.0	**Communication, Information Technology, Numerical**		
	1. Demonstrate understanding and respect for scientific values like openness, precision and reliability 2. Problem solving 3. Data analysis and interpretation 4. Ability to listen to others, communicate, motivate the team, and resolve any conflicts that may come up.	1. Encourage the student to ask for help if needed. 2. Focusing on some real results and its physical meaning.	1. Homework, problem solutions, assignment and. 2.Comments on some resulting numbers
5.0	**Psychomotor(if any)**		
5.1	**NA**		

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Exercises & Home works	All weeks	5 %
2	Participation	All weeks	5 %
3	In-Class Problem Solving	7th,13th week	10%
4	Midterm 1	6th week	15%
5	Midterm 2	10th week	15%
6	Final Exam	16th week	50%
	The Total		100%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) 1. - Allocate academic advisor for each student 2. Allocate the contact hours in each teacher's schedule 3. Declaration of teacher's schedule

E Learning Resources

1. List Required Textbooks 1. Kenneth S. Krane , Introductory nuclear Physics, first edition, Jone Wily & Sons Inc. (2008) ISBN 0 - 471-80553-X . 2. Hans Paetz gen. Schieck, "Nuclear Reactions: An Introduction (Lecture Notes in Physics) 2014th Edition" ISBN-13: 978-3642539855. 3. C.A. Bertulani , P. Danielewicz , "Introduction to Nuclear Reactions (Graduate Student Series in Physics) 1st Edition" (2004) ISBN-13: 978-0750309325. 4. Karlheinz Langanke, J.A. Maruhn , S.E. Koonin , "Computational Nuclear Physics 2: Nuclear Reactions " (1993) ISBN-13: 978-0387979540.
1. List Essential References Materials (Journals, Reports, etc.) - Edmund Storms, The Explanation of Low Energy Nuclear Reaction: An Examination of the Relationship Between Observation and Explanation (2014) ISBN 978-1-892925-10-7 . -Ian J. Thompson, Filomena M. Nunes , "Nuclear Reactions for Astrophysics: Principles, Calculation and Applications of Low-Energy Reactions", ISBN-13: 978-0849385483 (2009)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. 1. Power points (use e-learning gate of Umm Al-Qura university 2. Youtube videos(use e-learning gate of Umm Al-Qura university)

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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) • Lecture rooms must be around 20 students. • Library • Boards • Suitable lightening system • Fiber optic networks and wireless • Air condition units • Computers
2. Technology resources (AV, data show, Smart Board, software, etc.) • Computer Lab for Physics students. • Providing numbers of computers for students

• Updating the computer programs each year
2. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) • Checked later if needed

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching • Course reports • Course evaluation
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • Revision of student answer paper by another staff member. • Analysis the grades of students.
3. Procedures for Teaching Development • Preparing the course as PPT. • Using scientific flash and movies. • Annual updating of course content
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) • The course should be developed periodically to ensure that it contains the latest developments in the field of study. • Development could be put as an objective in the report of the course to be achieved each semester
4. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. 1- The following points may help to get the course effectiveness · Student evaluation · Course report · Program report · Program Self study · E-learning 2- According to point 1 the plan of improvement should be given. 3- Contact the college to evaluate the course and the benefit it add to other courses. Add some subject and cut off others depending on the new discoveries in physics.

Name of Course Instructor: Khaled Abdel-Waged

Signature: _____ **Date Completed:** _____

Program Coordinator: Khaled Abdel-Waged

Signature: _____ **Date Received:** _____

Course Title: Quantum Field Theory

Course Code: 403603-3

(N-3)

Date: 2018-7-10	**Institution:** Umm Al-Qura University
College: Faculty of Applied Science	**Department:** Physics

A. Course Identification and General Information

1. Course title and code: **Quantum Field Theory (403603-3)**
2. Credit hours: **3 hrs**
3. Program(s) in which the course is offered.

   (If general elective available in many programs indicate this rather than list programs)

   M. Sc. Physics
4. Name of faculty member responsible for the course: **One of the academic staff member**
5. Level/year at which this course is offered: **2nd Year / Level 3**
6. Pre-requisites for this course (if any): **Quantum Mechanics B.Sc**
7. Co-requisites for this course (if any):--
8. Location if not on main campus: **Main and Al-Zaher campus**
9. Mode of Instruction (mark all that apply):

a. Traditional classroom	✓	percentage?	100%
b. Blended (traditional and online)		percentage?	
c. E-learning		percentage?	
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course The Course provides the basic physics and formalism of quantum field theory. In particular, this course will provide the students with the ability to understand the concept of relativistic quantum field theory and be full proficient in perturbation theory calculations of Feynman diagrams for different processes within QED.

2. Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field) • Review the course description frequently and rewrite it according to modern data. • Develop learning strategies to increase student understanding of physical phenomena. • Encourage the student to use massive open online courses (MOOCs). • Increased student understanding by mentioning the applications of physical principle

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

1. Topics to be Covered		
List of Topics	**No. of Weeks**	**Contact hours**
1. Electromagnetic Field • Particles and fields • Electromagnetic field in the absence of charges • Electric dipole interaction • Electromagnetic field in the presence of charges	**1**	**3**
2. Lagrangian Field theory • Relativistic notation • Classical Lagrangian and Hamiltonian equations. • Quantized Lagrangian field theory • Symmetries and conservation laws	**2**	**6**
3. Spin-0 Fields: The Klein Gordon Equation • The neutral Klein Gordon Field • The Charged Klein Gordon Field • The invariant commutation relation	**2**	**6**
4. Spin-1/2 Fields: The Dirac Equation • The Dirac equation • Canonical quantization of the Dirac Field • The Fermion propagator	**3**	**9**

5. Photons: Covariant theory • The classical fields • Covariant quantization • The photon propagator	**2**	**6**
6. The S-matrix expansion • Natural dimensions and units • The S-matrix expansion • Wick's theorem	**2**	**6**
7. Feynman diagrams and rules in QED • Feynman Diagrams in configuration space • Feynman Diagrams in momentum space • Feynman rules for the S-Matrix • Feynman rules for QED	**3**	**9**

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	45 hrs	45 hrs				90 hrs
	Actual	45 hrs	45 hrs				90 hrs
Credit	Planned	45 hrs	45 hrs				90 hrs
	Actual	45 hrs	45 hrs				90 hrs

3. Individual study/learning hours expected for students per week. **8**

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
	Upon successful completion of this course The student will be able to: **1.** Recognize the basic formalism of quantum field theory. **2.** Describe the calculations of electromagnetic interactions by Feynman diagrams. **3.** Reproduce the calculations in terms of field quantization. **4.** Describe the quantization of relativistic particles of spin ½ and Klein and Dirac field Equation and its relation to non-relativistic quantum mechanics	**4.** using the achieved applications to Demonstrating the basic information and principles **5.** Discussing phenomena using pictures and diagrams. **6.** Diversity in lecturing method: • Blackboard • Power point • e-learning	2. Exams: • Online Quizzes • mid-term exam • Oral exams • Final exams 3. Discussions with the students.
2.0	**Cognitive Skills**		
	Upon successful completion of this course The student will be able to: **1.** Quantize the electromagnetic field by Fourier analyzing the classical field in the absence and presence of charges. **2.** Impose harmonic oscillator commutation relations. **3.** Learn the interaction occurring via the electric dipole moment of the system of charges. **4.** Calculate the transition probability per unit time between initial and final states. **5.** Quantize the system of moving charges in an electromagnetic field. **6.** Illustrate the application of the theory for radiative transition and Thomson scattering. **7.** Identify relativistic notations. **8.** Develop the classical Lagrangian field theory. **9.** Quantize the Lagrangian field theory	**5.** Preparing main outlines for teaching. **6.** Asking about physical laws previously taught and Following some proofs **7.** Define duties for each chapter. **8.** Homework assignments. **9.** Encourage the student to look for the information in different references. **10.** Ask the student to attend lectures and work out to solving problem. **11.** clearing the misunderstanding of some mathematical principle by discussing with the student	**3.** Exams of various kinds **4.** Writing reports on selected parts of the course. **5.** Discussions of how to simplify or analyze some phenomena.

	10. Introduce all symmetry properties and the conservation energy which contained in the Lagrangian density. **11.** Describe spin-0 particle by real and complex klein-Gordon equation. **12.** Analyze the field operator by Fourier analysis. **13.** derive Absorption and creation operator and impose its commutation relations **14.** Identify the normal product (normal ordering of operators) **15.** Illustrate the covariance of the commutation relations by calculating the commutator for two arbitrary space-time points. **16.** Apply canonical quantization formalism to relativistic material particles of spin 1/2 (Dirac equation). **17.** Conclude the anti-commutation relation between absorption and creation operator. **18.** Derive the number representation for fermions. **19.** Interpret and derive the fermion propagator **20.** Develop a covariant theory from an covariant formulation of classical electrodynamics. **21.** Apply the canonical formalism to quantize the free electromagnetic field. **22.** Interpret and derive the photon propagator. **23.** Introduce the natural dimensions and units. **24.** Derive the S-matrix expansion by study the equation of motion of the interacting fields in the interaction picture. **25.** Apply the wicks theorem to obtain the transition amplitude for a particular transition. **26.** Introduce the transition amplitude from the S-matrix expansion in a given order of perturbation theory.		

	27. Evaluate the transition amplitude in momentum space. **28.** Interpret the terms in the Wick expansion as Feynman diagram. **29.** Summarize the terms and diagrams as Feynman rules. **30.** Write down transition amplitudes directly from Wicks theorem. **31.** Apply the Feynman rules for QED.		
3.0	**Interpersonal Skills & Responsibility**		
	1. Ability to take responsibility and take the course instructions seriously. 2. The ability to be an effective member of the working group and communicate clearly. 3. Be able to analyze scientific problems in general and participate in discussion about different ways to address and solve problems. 4. Demonstrate understanding and respect for scientific values like openness, precision and reliability.	4. Working in small groups. 5. Learn how to search the internet and use the library. 6. Learn how to cover missed lectures. 7. Learn how to summarize lectures or to collect materials of the course. 8. Learn how to solve difficulties in learning: solving problems and enhance educational skills. 9. Develop the interest in Science through :(lab work, field trips). 10. Encourage the student to attend lectures regularly 11. Give students' tasks of duties	**3.** Discussion. **4.** The accuracy of the result gained by each group will indicate the good group work. **5.** Presenting the required research on time and the degree of the quality will show the sense of responsibility.
4.0	**Communication, Information Technology, Numerical**		
	5. Give good written and oral presentation of scientific topics and results. 6. Communicate scientific problems, analyses and conclusions within particle physics, both to specialists and the general public 7. Ability to listen to others, communicate, motivate the team, and resolve any conflicts that may come up.	3. Use the web for research. 4. Discuss with the student. 5. Exams to measure the numerical skill. 6. Encourage the student to ask for help if needed. 7. Focusing on some real results and its physical meaning. 8. Lectures for Computational analysis and data representation	2. Their interaction with the lectures and discussions. 3. The reports of different asked tasks. 4. Homework, problem solutions, assignment and exam should focus on the

		9. Encourage the student to ask good questions to help solve the problem. 10. Display the lecture note and homework assignment on the web. 11. Working in small groups.	understanding the results of computations and analysis. 5. Comments on some resulting numbers. 6. Research.
5.0	**Psychomotor(if any): NA**		

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Exercises & Home works	All weeks	5 %
2	Participation	All weeks	5 %
3	In-Class Problem Solving	7th,13th week	10%
4	Midterm 1	6th week	15%
5	Midterm 2	10th week	15%
6	Final Exam	16th week	50%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week)

4. Allocate academic advisor for each student
5. Allocate the contact hours in each teacher's schedule
6. Declaration of teacher's schedule

E Learning Resources

1. List Required Textbooks

- Graham Shaw and Franz Mandl, Quantum Field theory, John Wiley and Sons (2016), **ISBN-13:** 978-8126565061

2. List Essential References Materials (Journals, Reports, etc.)

- Bipin R. Desai, Quantum Mechanics with basic field theory (2010) Cambridge university press, ISBN 978-0-521-87760-2
- Andrei Smilga, Quantum Field Theory for the Gifted Amateur (2015) ISBN-13: 978-0199699339.
- Andrei Smilga Digestible Quantum Field Theory 1st ed. (2017) Edition" ISBN-13: 978-3319599205.
- Hagen Kleinert, "Particles and Quantum Fields ", (2016) ISBN-13: 978-9814740906 .

• Eberhard Zeidler , Quantum Field Theory I: Basics in Mathematics and Physics: A Bridge between Mathematicians and Physicists 2nd printing 2009. ISBN-13: 978-3540347620.
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
4. 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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) • Lecture room for 30 students. • Library • Classroom • Student Lounge • Computer lab
2. Technology resources (AV, data show, Smart Board, software, etc.) • Computer room. • data show • High speed network connection
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

Strategies for Obtaining Student's Feedback on Effectiveness of Teaching • Questionaries' (using of e-learning gate of Umm Al-Qura university) • Online Quizzes (using of e-learning gate of Umm Al-Qura university) • Open discussion (using of e-learning gate of Umm Al-Qura university)
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • At the end of term, Students fill an evaluation Sheet (without names). • Analysis the grades of students.
3. Procedures for Teaching Development • Strategies are modified each term according to the student feedback • Periodical revision of course content.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) After the agreement of Department and Faculty administrations • 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.

5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it.

4- The following points may help to get the course effectiveness
   - Student evaluation
   - Course report
   - Program report
   - Program Self study

5- According to point 1 the plan of improvement should be given.

6- Contact the college to evaluate the course and the benefit it add to other courses.

Add some subject and cut off others depending on the new discoveries in physics

Name of Course Instructor: Nuha Felemban

Signature: _____ Date Completed: _____

Program Coordinator: Khaled Abdel-Waged

Signature: _____ Date Received: _____

Course Title: High Energy Physics

Course Code: 403608-3

(N-4)

Date: 20....-.....-.....	**Institution:** UMM AL –QURA UNIVERSITY
College: Faculty of Applied Science	**Department:** Physics

A. Course Identification and General Information

1. Course title and code: **High Energy Physics (403608-3)**		
2. Credit hours: **3hrs**		
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) **M.Sc. in Physics**		
4. Name of faculty member responsible for the course: **One of the academic staff member**		
5. Level/year at which this course is offered: **1st Year / Level 2**		
6. Pre-requisites for this course (if any): **Quantum Field theory (403603-3) (M.Sc)**		
7. Co-requisites for this course (if any):		
8. Location if not on main campus: **Main and Al-Zaher campus**		
9. Mode of Instruction (mark all that apply):		
a. Traditional classroom	✓ percentage?	80 %
b. Blended (traditional and online)	percentage?	
c. E-learning	✓ percentage?	20%
d. Correspondence	percentage?	
f. Other	percentage?	

Comments: Tutorial Videos (plus a question library) are created by one of the Faculty members (Prof. Khaled Abdel-Waged) which covers Chapters 1 of the course. The online teaching is installed on the E-Learning Gate of Umm Al-Qura University.

B Objectives

1. The main objective of this course

This course aims to use the tools of quantum field theory to solve fundamental problems in elementary particle physics. In other words, the main goal is to guess a set of force laws, within the context of quantum field theory, to correctly describe the particle behavior. This course together with quantum field theory (**403505-3**) prepares the student with the background for research in elementary particle physics, in terms of M.Sc. thesis.

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

- Review the course description frequently and rewrite it according to modern data.
- Develop learning strategies to increase student understanding of physical phenomena.
- Encourage the student to use massive open online courses (MOOCs).
- Increased student understanding by mentioning the applications of physical principle

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

1. Topics to be Covered

List of Topics	**No. of Weeks**	**Contact hours**
1. Relativistic Kinematics • Lorentz transformation • Four vectors • Energy and momentum • Collisions • Examples and applications	2	6
2. Symmetries and invariance principles • Conservation laws • Spin and angular momentum • Flavor symmetries • Parity • Charge conjugation, CP violation, TCP theorem.	4	12

3. Feynman calculus • Life times and cross sections • The Golden rule • Toy theory • Scattering • Higher order diagrams	4	12
4. Quantum Electrodynamics • Dirac Equation • Solutions to Dirac Equation • Bilinear Covariant • The Photon • Feynman rules for QED • Cross sections and lifetimes	5	15

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	45 hrs	45 hrs				90 hrs
	Actual	45 hrs	45 hrs				90 hrs
Credit	Planned	45 hrs	45 hrs				90 hrs
	Actual	45hrs	45hrs				90 hrs

3. Individual study/learning hours expected for students per week. **8**

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	**Upon successful completion of this course The student will be able to:** 1. Classify various kinds of elementary particles, their properties such as mass, electric charge, spin, etc. 2. Determine the interaction laws of these elementary particles from scattering events, decays and bound systems. 3. Underline Feynman calculus to calculate cross sections and decay rates. 4. Understand the models and theories which explain the particle behaviour. 5. Describe the elementary particles dynamics. 6. Recognize the mathematical description of symmetry and the relation between symmetry and conservation laws (Nether's theorem) 7. Define the discrete symmetries (parity, charge conjugate and time reversal)	1. Demonstrating the basic information and principles through lectures and the achieved applications 2. Discussing phenomena with illustrating pictures and diagrams 3. Lecturing method: • E-learning gate of Umm Al-Qura university • Power point • Tutorials • Revisit concepts • Discussions • Brain storming sessions 4. Learn the student background of the subject.	4. Exams: • Online Quizzes • mid-term exam • Oral exams • Final exams 5. Discussions with the students. 6. Ask the student to clear the misunderstanding of some mathematical principle. 7. Ask quality question.
2.0	**Cognitive Skills**		
2.1	**Upon successful completion of this course The student will be able to:** 1. Analyse and explain natural phenomena. 2. Apply Lorentz transformation between two systems 3. Introduce and apply the position-time (covariant and contravariant) vector 4. Conclude the energy and momentum in relativistic domain	1. Preparing main outlines for teaching 2. Following some proofs 3. Define duties for each chapter 4. Homework assignments 5. Encourage the student to look for the information in different references	1. Midterm's exam. Exams, short online quizzes 2. Asking about physical laws previously taught 3. Writing reports on selected parts of the course 4. Discussions of how to simplify or

	5. Apply conservation of energy and momentum in collisions 6. Describe the mathematical description of symmetry and the relation between symmetry and conservation laws (Neither's theorem) 7. Learn rotational symmetry and its relation to angular momentum and spin 8. Calculate the total angular momenta (addition) for different system 9. Understand the discrete symmetries (parity, charge conjugate and time reversal) 10. Calculate decay rates and scattering cross section by using Golden rules 11. Sketch the Feynman diagram for any process 12. Determine the transition amplitude using the Feynman rules 13. Conclude and solve the Dirac equation 14. Illustrate how Dirac spinor transform under change inertial system 15. Calculate the wave function of photon 16. Calculate cross section and life time of scattering and annihilation	6. Ask the student to attend lectures for practice solving problem 7. Ask the student to do small research 8. Explain the idea with the student own words. 9. Show the best ways to deal with problem 5. Build a strategy to solve problem. • How to use physical laws and principles to understand the subject • How to simplify problems and analyze phenomena	analyze some phenomena
3.0	**Interpersonal Skills & Responsibility**		
3.1	1. Give good written and oral presentation of scientific topics and results. 2. The students learn independently and take up responsibility	1. Learn how to search the internet and use the library. 2. Learn how to cover missed lectures. 3. Learn how to summarize lectures or to collect materials of the course. 4. Learn how to solve difficulties in learning: solving problems and enhance educational skills.	1. Online Quizzes on the previous lecture 2. Creating reports 3. Discussion 4. The accuracy of the result gained by each group will indicate good group work 5. Presenting the required research

		5. Develop her interest in Science through :(lab work, field trips, visits to scientific and research. 6. Encourage the student to attend lectures regularly. 7. Give students tasks of duties	on time and the degree of the quality will show the sense of responsibility.
4.0	**Communication, Information Technology, Numerical**		
4.1	1. Communicate scientific problems, analyses and conclusions within particle physics, both to specialists and the general public. 2. Problem solving 3. Data analysis and interpretation. 4. Feeling physical reality of results	1. Know the basic physical principles. 2. Use the web for research. 3. Discuss with the student. 4. Clear the weakness point that should be eliminated. 5. Encourage the student to ask for help if needed. 6. Focusing on some real results and its physical meaning. 7. Lectures for Computational analysis and data representation 8. Encourage the student to ask good question to help solve the problem. 9. Display the lecture note and homework assignment at the web.	1. Online quizzes 2. Interaction the student with the lectures and discussions. 3. The reports of different asked tasks. 4. Homework problem solutions assignment and exam should focus on the understanding the results of computations and analysis. 5. Comments on some resulting numbers. 6. Research.
5.0	**Psychomotor(if any)**		
5.1	Not applicable		

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Online quizzes	every week	5 %
2	Homework	Every week	10 %

3	Midterm 1	7th week	15 %
4	Midterm 2	14th week	15 %
5	Interactive discussions	Every week	5 %
6	Final exam	End of semester	50 %

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week)

7. Allocate academic advisor for each student
8. Allocate the contact hours in each teacher's schedule
9. Declaration of teacher's schedule

E Learning Resources

1. List Required Textbooks

1. David Griffiths, Introduction to elementary particles (2008) Wiley-VCH Verlag GmbH and Co. K GaA, Weinheim, ISBN-13: 978-3527406012.
2. Robert Purdy, "Particle Physics: An Introduction (Essentials of Physics Series)", (2018) ISBN-13: 978-1683921424.
3. Brian R. Martin and Graham Shaw, "Particle Physics (Manchester Physics Series) 4th Edition" (2017) ISBN-13: 978-1118912164.
4. Francis Halzen and Alan D. Martin, Quarks and Leptons: an introductory course in modern particle physics (2008) John Wiley and Sons, Inc. **ISBN-13:** 978-8126516568

2. List Essential References Materials (Journals, Reports, etc.)

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

4. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

- Power points (use e-learning gate of Umm Al-Qura university)
- Youtube videos(use e-learning gate of Umm Al-Qura university)

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.)

1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)

- Class room is already provided with data show.
- Classroom
- Library
- Student Lounge
- Computer lab

2. Technology resources (AV, data show, Smart Board, software, etc.) • Providing class rooms with computers and labs with data show. • High speed network connection
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching • Questionaries' (using of e-learning gate of Umm Al-Qura university) • Online Quizzes (using of e-learning gate of Umm Al-Qura university) • Open discussion (using of e-learning gate of Umm Al-Qura university)
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • At the end of term, Students fill an evaluation Sheet (without names). • Analysis the grades of students.
3. Procedures for Teaching Development • Strategies are modified each term according to the student feedback • Periodical revision of course content.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) After the agreement of Department and Faculty administrations • 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.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. 1. The following points may help to get the course effectiveness • Student evaluation • Course report • Program report • Program Self study • E-learning 2. According to point 1 the plan of improvement should be given.

Name of Course Instructor: Nuha Felemban

Signature: _____ Date Completed: _____

Program Coordinator: Khaled Abdel-Waged

Signature: _____ Date Received: _____

Course Title: Detector Physics

Course Code: 403607-3

(N-5)

Date: 27-1-1440....-	**Institution: UM AL – QURA UNIVERSITY**.
College: Faculty of Applied Science	**Department:** . **Physics** .

A. Course Identification and General Information

1. Course title and code: **Detector physics 403607-3**		
2. Credit hours: **3hrs**		
3. Program(s) in which the course is offered. **M.Sc. in 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 academic staff member**		
5. Level/year at which this course is offered: **2nd year/ level 3**		
6. Pre-requisites for this course (if any):): Introduction to Nuclear and High Energy Physics (**403601**)		
7. Co-requisites for this course (if any): --		
8. Location if not on main campus: **Main campus**		
9. Mode of Instruction (mark all that apply):		
a. Traditional classroom	**√** percentage?	**75**
b. Blended (traditional and online)	**√** percentage?	**15**
c. E-learning	**√** percentage?	**10**
d. Correspondence	percentage?	
f. Other	percentage?	
Comments:		

B Objectives

1. The main objective of this course The goal of the course is to convey an understanding of how detectors in particle physics, heavy-ion physics work.

Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field) -Encourage the student to use massive open online courses (MOOCs). -Increased student understanding by mentioning the applications of physical principle

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

2. Topics to be Covered		
List of Topics	**No. of Weeks**	**Contact hours**
1- Interactions of electrons and charged heavy particles in matter - Cross section, mean free path, surface density units. - Bohr's calculations - The Bethe-Bloch formulae - Energy dependence -Scaling law for dE/dx -Mass stopping power -Limitations on the Bethe-Bloch Formula and other effects. - Channeling -Range	**3**	**9**
2- Counting statistics and error prediction		

-Characterization of data -Statistical models -Applications of statistical models -Error propagation -Optimization of counting experiments -Limits of detectability -Distribution of time intervals	3	9
3- Radiation detectors		
-Simplified detector model -Modes of detector operation -Pulse Height spectra -Counting curves and plateaus -Energy resolution -Detection efficiency -Dead time	2.5	7.5
4- Ionization Detectors		
-Gaseous ionization detectors -Ionization and transport phenomena in Gases -Transport of electrons and ion in Gases -Proportional counter -Drift chamber -Liquid ionization detectors	2.5	7.5
5-Gamma ray detectors		
-The Photon-cathode -Photomultiplier tube characteristics -Scintillation pulse shape analysis - Germanium detector configurations	2	6
6-Neutron detection		

-Nuclear reactions of interest in neutron detection - Detectors based on boron reaction - counters based on neutron moderation - Detectors based on fast neutron induced reactions	**2**	**6**
Total	**15**	**45**

Lecture : 45 hrs	**Tutorial:**	**Lab:**	**Total: 45 hrs**

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	45 hrs	45 hrs				90 hrs
	Actual	45 hrs	45 hrs				90 hrs
Credit	Planned	45 hrs	45 hrs				90 hrs
	Actual	45 hrs	45 hrs				90 hrs

3. Individual study/learning hours expected for students per week. **8**

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code	NQF Learning Domains	Course Teaching	Course Assessment

#	And Course Learning Outcomes	Strategies	Methods
1.0	**Knowledge**		
	The student will know		
1.1	all basic interaction processes of electrons, heavy charged particles and photons in matter and electromagnetic fields.	1.Demonstrate the basic information and principles 2.Diversity in lecturing method: • Blackboard • Power point • e-learning	Exams: • Online Quizzes • mid-term exam • Oral exams • Final exams -Discussions with the students
1.2	which experimental technique is best for measuring a specific particle property		
1.4	the statistical analysis required to process the results of nuclear experiments.		
2.0	**Cognitive Skills**		
2.1	will have sufficient background to read detector papers.	-Define duties for each chapter. -Homework assignments. -Encourage the student to look for the information in different references.	-Writing reports on selected parts of the course. -Discussions
2.2	will have sufficient background to understand how most detectors in nuclear physics work.		
2.3	will have sufficient background to understand how most detectors in particle physics work.		
3.0	**Interpersonal Skills & Responsibility**		
3.1	-Be able to analyze scientific problems in general and participate in discussion about different ways to address and solve problems -The ability to be an effective member of the working group and communicate clearly. -Ability to motivate and encourage others, and help a team achieve success.	-Working in small groups. -Learn how to search the internet and use the library. -Learn how to summarize lectures or to collect materials of the course. -Develop the interest in Science through : (lab work, field trips).	-Discussion. -Presenting the required research on time and the degree of the quality will show the sense of responsibility.
4.0	**Communication, Information Technology, Numerical**		
	-Be able to reflect over central scientific problems in his/her own work and other people's work. -Problem solving -Data analysis and interpretation	-Exams to measure the numerical skill. -Focusing on some real results and its physical meaning.	-Their interaction with the lectures and discussions. -The reports of different asked tasks.

	-Ability to listen to others, communicate, motivate the team, and resolve any conflicts that may come up.	-Display the lecture note and homework assignment on the web. -Working in small groups.	-Comments on some resulting numbers. -Research Project
5.0	**Psychomotor(if any)**		
5.1	**NA**		

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Exercises & Home works+ quizzes	All weeks	5%
1	Assay	15th week	5%
3	Report	All weeks	20 %
4	Written Test (1)	6th week	10%
5	Written Test (1)	11th week	10%
6	Final examination	16th week	50%
	The Total		100%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week)

-Three contact hours/week.

-Four office hours/week.

E Learning Resources

1. List Required Textbooks

1. William R. Leo, Techniques for nuclear and particle physics, Springer Verlag (1987) ISBN 3-540-17386-2 Springer Verlag Berlin Heidelbergy New York
2. Glenn F. Knoll, Radiation Detection and Measurement, John Wiley & Sons, Inc. (1999) ISBN 0-471-07338-5.
3. Stefaan Tavernier, Experimental Techniques in Nuclear and Particle Physics 2010th Edition, ISBN-13: 978-3642008283.

4. Lucio Cerrito , Radiation and Detectors: Introduction to the Physics of Radiation and Detection Devices (Graduate Texts in Physics) 1st ed. (2017) Edition, ISBN-13: 978-3319531793.
5. Claus Grupen and Boris Shwartz , Particle Detectors (Cambridge Monographs on Particle Physics, Nuclear Physics and Cosmology) 2nd Edition (2011) ISBN-13: 978-0521187954.
6. Olaf Behnke , Kevin Kroninger, Gregory Schott, Thomas Schorner-Sadenius , Data Analysis in High Energy Physics: A Practical Guide to Statistical Methods (2013) ISBN-13: 978-3527410583.

2. List Essential References Materials (Journals, Reports, etc.)

1. Journal :Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment.
2. Geoffrey G Eichholz and John W.Poston, Principles of Nuclear Radiation Detection, Ann Arbor Science Publishers (April 1, 1980) ISBN-13: 978-0250402632

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

4. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

3. Power points (use e-learning gate of Umm Al-Qura university
4. Youtube videos(use e-learning gate of Umm Al-Qura university)

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.)

3. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)

- Lecture rooms must be around 20 students.
- Library
- Boards
- Suitable lightening system
- Air condition units
- Computers

2. Technology resources (AV, data show, Smart Board, software, etc.)

- Computer Lab for Physics students.
- Providing numbers of computers for students
- Updating the computer programs each year

4. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

- Checked later if needed

G Course Evaluation and Improvement Procedures

5. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

- Course reports
- Course evaluation

6. Other Strategies for Evaluation of Teaching by the Instructor or the Department

- Revision of student answer paper by another staff member.

• Analysis the grades of students.
7. Procedures for Teaching Development • Preparing the course as PPT. • Using scientific flash and movies. • Annual updating of course content
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) • The course should be developed periodically to ensure that it contains the latest developments in the field of study. • Development could be put as an objective in the report of the course to be achieved each semester
8. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. 7- The following points may help to get the course effectiveness · Student evaluation · Course report · Program report · Program Self study 8- According to point 1 the plan of improvement should be given. 9- Contact the college to evaluate the course and the benefit it add to other courses.

Name of Course Instructor: Walid Altaf

Signature: _____ **Date Completed:** _____

Program Coordinator: Khaled Abdel-Waged

Signature: _____ **Date Received:** _____

Course Title: Computer Methods in Medical Physics

Course Code: 403612-3

(N-6)

Date: 20....-.....-.....	**Institution**: .....uqu.....
College: Faculty of Applied Science	**Department**: Physics Department.

A. Course Identification and General Information

1. Course title and code: **Applications of nuclear codes in Medicine (403612)**
2. Credit hours: 3 hrs
3. Program(s) in which the course is offered. Master of Medical Physics

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course. **ProF.Dr.Samir**
5. Level/year at which this course is offered: **2nd year, Level 3**
6. Pre-requisites for this course (if any):
7. Co-requisites for this course (if any):
8. Location if not on main campus:
9. Mode of Instruction (mark all that apply):

a. Traditional classroom	√	percentage?	70
b. Blended (traditional and online)	√	percentage?	10
c. E-learning	√	percentage?	20
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course: : Course Description: In this course, students will familiarize themselves with the modeling of radiation fields during modern radiotherapy and on the real patients' daily cases. And identify the physical bases behind all the options of these mathematical programs. The student does all the necessary dependencies of the planning that he works. The student will actually visit a hospital in the area to work on the planning equipment for external and internal radiation therapy

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

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Digital Image Communication (DICOM) and Picture Archiving Communication System (PACS) Introduction to DICOM DICOM and Clinical data Medical Image in DICOM DICOM Communication DICOM and Tele-radiology DICOM Applications	2	6
Medical Simulators Simulation Modalities and Technology Simulation for health care disciplines	2	6
Monte Carlo Calculations	2	6
Computational Methods for Radiological Sciences	2	6
Mathematical Methods for Radiological Sciences	2	6
Mathematical Methods for Imaging in Medicine	2	6
Digital X-Ray Imaging and Computed Tomography Biomedical image processing Noise reduction Biomedical image segmentation	3	9
Total	15	45

2. Course components (total contact and credit hours per semester):							
		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	45 hrs				45 hrs	90 hrs
	Actual	45 hrs				45 hrs	90 hrs
Credit	Planned	45 hrs				45 hrs	90 hrs
	Actual	45 hrs				45 hrs	90 hrs

3. Individual study/learning hours expected for students per week.	8

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	recognize the Medical Simulators and understand its operational method	**Lectures** **Discussions** **Visual presentation**	Exams Midterms Final examination
1.2	Define the Mathematical Methods for Imaging in Medicine	**Lectures** **Discussions** **Visual presentation**	Home work. Quizzes
1.3	Describing Digital X-Ray Imaging and Computed Tomography	**Lectures** **Discussions** **Visual presentation**	Continuous discussions with the students during the lectures.
2.0	**Cognitive Skills**		

2.1	Summarizing the Medical Simulators operational method	**Encourage** the student to look for some books in the different references describing radiation.	Midterm exams Quizzes
2.2	Evaluate Mathematical Methods for Imaging in Medicine	**Ask** the student to attend lectures for radiation effects	Doing homework Check the problems solution
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate the medical Simulators Tech.	Ask the students to search the internet and use the library. Encourage them how to attend lectures regularly by assigning marks for attendance.	Quizzes of some previous lectures. Ask the absent students about last lecture
3.2	Evaluate the Medical Simulators in Imaging.	Teach them how to cover missed lectures. Give students tasks of duties	Discussion during the lecture.
4.0	**Communication, Information Technology, Numerical**		
4.1	Outline how to communicating with: Peers, Lecturers and Community.	Creating working groups with peers to collectively prepare: solving problems and search the internet for	Discussing a group work sheets.
4.2	The student should **interpret** how to Know the basic principles using the internet for radiation measurements	Give the students tasks to measure their: practical skills, analysis and problem solving	Discuses with them the results of computations analysis and problem solutions.
4.3	The student should **appraise** how to Use the computer skills and library.	Encourage the student to ask for help if needed.	Give homework's to know how the student understands the numerical skills.
4.4	demonstrate how to Search I the internet and using software programs to deal with technique.	Encourage the student to ask good question to help solve the problem.	Give them comments on some resulting numbers
5.0	**Psychomotor(if any)**		
5.1	Not applicable	Not applicable	Not applicable
5.2	Not applicable	Not applicable	Not applicable

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Midterm 1	5th week	20 %
2	Research	10th week	10%

4	Homework + reports	15th week	20%
5	Final exam	End of semester	50 %

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week)

1- 8-office hours per week in the lecturer schedule.

2- The contact with students by e-mail and website.

E Learning Resources

1. List Required Textbooks

-Digital Imaging and Communications in Medicine (DICOM), Oleg S. Pianykh A Practical Introduction and Survival Guide Second Edition, (2011).ISBN-13: 978-3642108495.

-The Comprehensive Textbook of Healthcare Simulation, Adam I. Levine Samuel DeMaria Jr. Andrew D. Schwartz Alan J. Sim Editors (2014). ISBN-13: 978-1461459927

2. Essential References

-Digital Image Processing for Medical Applications, GEOFF DOUGHERTY (2009) ISBN-13: 978-0521860857.

- K.S. Chuang, H.K. Huang, O. Ratib, A.R. Bakker, G. Witte, Picture Archiving and Communication Systems (PACS) in Medicine (2012) ISBN-13: 978-3642765681 .

-Handbook of Physics in Medicine And Biology, Robert Splinter, CRC Press is an imprint of Taylor & Francis Group, an Informa business (2010) ISBN-13: 978-1420075243.

- Omer Demirkaya, Musa H. Asyali , Prasanna K. Sahoo, Image Processing with MATLAB: Applications in Medicine and Biology (MATLAB Examples) (2008) ISBN-13: 978-0849392467

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

https://www.slideshare.net/VictorEkpo2/the-role-of-computers-in-medical-physics

4. 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.)

1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)

Classroom with capacity of 10-students. - Library.
2. Technology resources (AV, data show, Smart Board, software, etc.)
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching. Student evaluation electronically organized by the University.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department. The colleagues who teach the same course discuss together to evaluate their teaching.
3. Procedures for Teaching Development. Course report, Program report and Program self-study.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) The instructors verify the students achievement from the course by evaluating the student reports and exams .
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. 1-The following points may help to get the course effectiveness: Student evaluation. * Course report * Program report. * Program self-study 2- According to point 1 the plan of improvement should be given

Name of Course Instructor: **Prof.Dr. Samir Nitto**
Signature: _____ **Date Completed:** _____

Program Coordinator: **Khaled Abdel-Waged**

Signature: _____ **Date Received:** _____

Material Science track

Course Title: Solid State Physics

Course Code: **403631-3.**

(M-1)

Date: 20....-.....-.....	**Institution:** UMM AL – QURA UNIVERSITY.
College: Faculty of Applied Science.	**Department:** of physics.

A. Course Identification and General Information

1. Course title and code: Condensed Matter Physics and **403631-3.**
2. Credit hours: 3 h.
3. Program(s) in which the course is offered. **M.Sc. 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 academic staff member**
5. Level/year at which this course is offered: **1st Year / Level 2**
6. Pre-requisites for this course (if any):
7. Co-requisites for this course (if any):
8. Location if not on main campus: **Main campus**
9. Mode of Instruction (mark all that apply): a. Traditional classroom ✓ percentage? 75 b. Blended (traditional and online) ✓ percentage? 15 c. E-learning ✓ percentage? 10 d. Correspondence ☐ percentage? ☐ f. Other ☐ percentage? ☐ Comments:

B Objectives

1. The main objective of this course

- To explain the basic concepts of the structures in solids and physical properties of crystalline substances by using XRD.
- To review on the electron theories in solid state material and its role in physical properties such as: electrical, thermal, magnetic and dielectrics and semiconducting …
- To study the physical properties of non-crystalline material (conduction mechanisms and optical properties).
- To use physical models to achieve calculations of the properties of solids.
- To study the transport phenomena and theory in sold state materials.
- To study the phase diagram of materials and alloys.
- To study the science of some solid materials such as glasses, polymers, semiconductors…
- To understand the various electric field and magnetism related concepts of condensed matter physics.
- To enhance the knowledge in understanding advanced topics such as superconductivity.

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

This course and its contents are designed to obey most current learning theories arising from learning and cognitive sciences as well as the teaching strategy outlined in this course. Any development will be made by qualified faculty members that teaching this course based on their assessment of the skills and needs of their students and the techniques.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

The course gives the mathematical treatment of the basic properties of the condensed materials especially in solids. The structure of materials is the main factor which controls the physical properties, such as thermal, electrical, optical, magnetic, dielectric etc. In this course we will learn the structure as well as physical properties of some materials such as glasses, polymers and semiconducting materials.

1. Topics to be Covered		
List of Topics	**No. of Weeks**	**Contact hours**

Lattice Vibrations and Thermal Properties:: Vibrations of monatomic and diatomic lattices - acoustic and optical modes - Quantization of lattice vibrations - Phonon Momentum - Inelastic scattering of neutrons by phonons. Lattice Heat Capacity - Einstein model, Density of modes in one and three dimensions -Debye model of lattice heat capacity – Debye's T3 law -Anharmonic crystal Interactions - Thermal Expansion - Thermal conductivity.	3	9
Band Theory: Energy levels and density of orbitals in one dimension - Free electron gas in three dimensions - Heat capacity of the electron gas - Electrical conductivity and Ohm's law - Motion in magnetic fields - Hall effect-Thermal conductivity of metals - Wiedemann-Franz law - Nearly free electron model- Wave equation of electron in a periodic potential - Number of orbitals in a band - Construction of Fermi Surfaces -Calculation of Energy Bands -Experimental methods in Fermi surface studies.	3	9
Transport Phenomena in solid materials: **DIFFUSION AND DRIFT:** Flux of particles. Fick's equation. -Time-dependent case. Solutions of the diffusion equation (or Fick's second law) . Thin layer or instantaneous source. The Boltzmann transformation. Relation between drift and diffusion. The Nernst-Einstein equation. Diffusion with phase change. Multiphase diffusion. The nature of the driving force. A variety of diffusion processes and generalization of Fick's law **DIFFUSION MECHANISMS AND CORRELATION EFFECTS** Mechanisms of diffusion. Direct interchange. Mechanisms involving point defects. Definition of the correlation factor. The encounter model. A simple simulation of self-diffusion and electro migration. Methods of calculating the correlation factor. Types of correlation factors. Dynamic correlations. Physical correlation. Meaning of the physical correlation factor. Compounds with a high concentration of defects. The potential-barrier model. Some simple applications of the potential-barrier model **SOLUTE DIFFUSION IN PURE MATERIALS. DIFFUSION IN ALLOYS** Solute diffusion at infinite dilution. Interstitial solid solutions Ionic crystals. Semiconductors Dilute alloys Diffusion in homogeneous concentrated alloys Superionic conductors Amorphous materials .	3	9
Non-crystalline solid materials Introduction to non-crystalline and amorphous materials (polymers, glasses, etc.) -Structure and chemistry of amorphous and non-crystalline materials: molecular structure of polymers; polarization and defects; thermoplastic and thermosetting polymers; crystallinity and elastomers -Glass: formation, structure and transition temperature, -Thermodynamics of glass formation; kinetics of glass formation -Properties of amorphous and non-crystalline materials: mechanical, electrical, thermal, dielectric, and optical	3	9

Phase diagrams: Basic concept. Phase and phase equilibrium Phase structures in solids Phase transitions and classification Single component phase diagram and solidification of pure crystals. Phase rule and phase equilibrium conditions Liquid structure, cooling curve Pure metal crystallization conditions Binary phase diagram and solidification of its alloy The conditions of phase equilibrium, the application of the phase rule. Lever law and its application Crystallization and nucleation conditions of solid solution alloys Types of phase diagram. Phase change kinetics Phase transformation process Phase change kinetics. Ternary phase diagrams Basis of ternary phase diagrams. Types of ternary phase diagrams Method for determination of phase diagram	3	9
	15 weeks	45 hrs

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	45 hrs	45 hrs	----------	---------	-------	90 hrs
	Actual	45 hrs	45 hrs				90 hrs
Credit	Planned	45 hrs	45 hrs				90 hrs
	Actual	45 hrs	45 hrs				90 hrs

3. Individual study/learning hours expected for students per week. 8hrs

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

The aim of this course is to provide students with fundamental of the solid state physics. After completion of the course the students should be able to :

understand of the basic concepts on properties of materials in solid state physics.

use the physical models to perform calculations of the properties of solids,

give an general idea of an application related to the physical phenomena treated in the course.

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 targeted learning outcomes. **Third**, insert appropriate

assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Define crystal structures of solids, crystal binding and lattice dynamics.	-Solve problems -Explain key concepts; -Provide numerical examples	-Midterm exams -Homework and Activities -Quizzes
1.2	Express the problem of electrons in a periodic potential, examine its consequence on the band-structure of solids.		
1.3	Explain the behaviour of solid matters by solid state theory, principles and used mathematical methods to solve physics problems..		
1.4	Describe the electronic properties of conductors, insulators, semiconductors and the interfaces between materials (metal/semiconductor).		
1.5	Describe the details of magnetism and superconductivity.		
2.0	**Cognitive Skills**		
2.1	Understand the structure of crystalline solid materials, and dynamics of electrons in solids.	-Asking questions during lectures. -Discussion	-Exam must contain questions that can measure these skills.
2.2	Theoretical descriptions of crystal and electronic structure, lattice, electrical and optical properties of different materials (metals, semiconductors, dielectrics, magnetic materials and superconductors) based on classical and quantum physics		
2.3	Get familiar with basic mathematical models of solid state and data analysis.		
3.0	**Interpersonal Skills & Responsibility**		
3.1	The ability to hard work independently and with groups.	Small group discussion.	

4.0	**Communication, Information Technology, Numerical**		
4.1	know how to use computer codes in solid state physics.	. -Seminars. Presentation.	.
5.0	**Psychomotor(if any)**		
5.1	Not applicable.	Not applicable.	Not applicable.

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Midterm 1	5th week	15 %
2	Midterm 2	10th week	15 %
3	quizzes	During the semester	10%
4	Home works	During the semester	10%
5	Final exam	15th week	50%
6	Total		100 %

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week)

E Learning Resources

1. List Required Textbooks

-Kittel, C., Introduction to Solid State Physics, John Willey, (2007).

-H. Ibach, H. Luth "Solid-state physics : an introduction to theory and experiment" spring verlag 1991

-J.R. Hook, H.E. Hall "Solid state physics" 2nd edition 1995 Kindle Edition.

-Atom Movements—Diffusion and Mass Transport in Solids .J.Philibert , 2012 Publisher: EDP Sciences

2. List Essential References Materials (Journals, Reports, etc.)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. Electronic Materials, Web Sites etc.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. The student used any Mathematical program, Maple, Matlab, to draw and solve the problems.

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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) The area of class room is suitable concerning the number of enrolled students (30) and air conditioned.
2. Technology resources (AV, data show, Smart Board, software, etc.)Computer Lab..
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching • Questionnaires • Open discussion in the class room at the end of the lectures
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • Revision of student answer paper by another staff member. • Analysis the grades of students.
3. Procedures for Teaching Development • Course report. • Program report and Program self-study and a tutorial lecture
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. • Periodical revision by Quality Assurance Units in the Department and institution

Name of Course Instructor: Dr. Ahmad Al Hadi_____

Signature: _____ **Date Completed:** _____

Program Coordinator: _____Prof. Adel Madani_____

Signature: _____ **Date Received:** _____

Course Title: **Advanced Crystallography**

Course Code: **403633-3**

(M-2)

Date: 20 .....-.....-....	**Institution: Umm Al-Qura University**
College: Applied Science	**Department : Physics**

A. Course Identification and General Information

1. Course title and code: **Advanced crystallography**
2. Credit hours: **3h**
3. Program(s) in which the course is offered. **M. Sc. Physics** (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course
5. Level/year at which this course is offered: **1st Level/1st Year**
6. Pre-requisites for this course (if any):
7. Co-requisites for this course (if any):
8. Location if not on main campus: **Main campus and Al-Zaher Branch**
9. Mode of Instruction (mark all that apply): a. Traditional classroom [√] percentage? 90 b. Blended (traditional and online) [ ] percentage? [ ] c. E-learning [√] percentage? 10 d. Correspondence [ ] percentage? [ ] f. Other [ ] percentage? [ ] Comments:
Experimental demonstration will be done if necessary.

B Objectives

The main objective of this course is :

- To present the basic concepts needed to understand the crystal structure of materials.
- To study fundamental concepts including lattices, symmetries, point groups, space groups, and the relationship between crystal symmetries and physical properties will be addressed.
- To covered the theory of X-ray diffraction by crystalline matter along with the experimental x-ray methods used in order to determine the crystal structure of materials.
- To briefly discussed application of X-ray diffraction to advanced materials, electron diffraction and neutron diffraction.
- To provide to the students an overview on the most used experimental methods providing information on the structure of matter in all its forms: solids (crystalline and amorphous) liquid and gases; pure and composite materials; bulk and nanostructured materials.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

In this course we will:

- Define concepts such as lattice, point and space groups,

- Define Bragg's law and explain its relation to crystal structure

- Identify and describe different diffraction methods

- Interpret and assign X-ray and electron diffraction patterns

- Describe briefly any plans for developing and improving the course that are being implemented. (e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field).

- Obtain knowledge on fundamentals of single crystal X-ray diffraction and advanced knowledge of practical steps in crystal structure determination.

- Use of crystallographic databases and crystallographic programs in the examination of modern materials: ceramics, alloys, cements, etc. Testing the relationships between crystallographic parameters and material properties.

- Use of modern crystallographic methods for the qualitative and quantitative determination of the composition of monophase and polyphase samples of various materials. Application of different programs and methods for calculating the parameters of the unit cell and microstructural parameters.

- Understand the symmetry in crystals (basic group theory, point and space groups, lattices); crystallographic computation (metrics, the reciprocal lattice, basis transformations and rotations, least squares, analysis of crystallographic results).

1. Topics to be Covered		
List of Topics	**No. of Weeks**	**Contact hours**
1 - Symmetry operations : **1.1.** Direct and reciprocal lattice, **1.2.** Rotation axis, inversion axis, glide planes, centrum of symmetry, **1.3.** International tables for Crystallography.	1	3
2 - Diffraction from Polycrystalline Samples and Determination of Crystal Structure : **2.1**. X-ray Diffractometer Essentials, Bragg's law, **2.2.** Estimation of X-ray Diffraction Intensity from a Polycrystalline Sample, **2.2.1**. Ewald construction, **2.2.2.** Structure Factor, **2.2.3.** Polarization Factor, **2.2.4.** Multiplicity Factor, **2.2.5.** Lorentz Factor, **2.2.6.** Absorption Factor, **2.2.7.** Temperature Factor.	2	6
3 - Factors affecting the intensity of diffraction: **3.1.** Absorption correction, **3.2.** Lorentz polarization correction, **3.3.** secondary extinction.	1	3
4 - Structure determination methods: **4.1.** Fourier transformation, **4.2.** Phase problem methods, **4.3.** Patterson synthesis, **4.4**. Direct methods.	1	3

5 - Crystal structure refinement: **5.1.** Model refinement of the crystal structure. **5.2.** Crystallographic software, disorder, modulated structure, error analysis **5.3.** Examples of structure refinement software (Rieldvelt , shelix ….)	2	6
6 - Crystallographic databases: **6.1** Cambridge structural database, statistical treatment of structural data.	1	3
7 - Analysis methods for powder: **7.1.** Quality, quantity, crystal structure from powder data **7.2.** Identification of an Unknown Sample by X-ray Diffraction (Hana Walt Method **7.3.** Determination of Lattice Parameter of a Polycrystalline Sample **7.4.** Quantitative Analysis of Powder Mixtures and determination of Crystalline Size and Lattice Strain **7.5.** Quantitative Determination of a Crystalline Substance in a Mixture **7.6.** Measurement of the Size of Crystal Grains and Heterogeneous Distortion	3	9
8. Reciprocal Lattice and Integrated Intensities of Crystals: **8.1.** Mathematical Definition of Reciprocal Lattice **8.2.** Intensity from Scattering by Electrons and Atoms **8.3** Neutron diffraction concept	1	3
9. Interpretation of the structural results: **9.1.** Interpretation and visualization of the crystal structure, **9.2.** Interpretation of publishes structural results.	1	3
10. single crystal structure refinement: **10.1.** Data collection of accurate structure factors for multipolar refinement. **10.2.** Quality of single crystal, data collection at low temperature, error analysis	1	3
11. Charge density analysis. AIM analysis: Relation of the experimental and theoretical electronic structure and their correlation to chemical and physico-chemical properties.	1	3
Total	15 weeks	45 h

2. Course components (total contact and credit hours per semester):						
	Lecture	**Tutorial**	**Laboratory/**	**Practical**	**Other**	**Total**

				Studio			
Contact Hours	Planned	45	45				
	Actual						
Credit	Planned	3	3				
	Actual						

3. Individual study/learning hours expected for students per week.	3h
2h office hours per week	

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

After successfully completing the course, the student is able to: Demonstrate knowledge of single crystal X-ray diffraction methods; experimentally perform diffraction experiment; determine and refine crystal structure; validate and interpret results of structural analysis; use Cambridge Structural Database.

Theoretical instruction: Geometry of X-ray diffraction. Braggs law. Reciprocal lattice and Evald construction. Relationship between electron density and structure factor. Four circle diffractometer. Diffraction data collection and reduction. Determination of crystal system, unit cell and space group. Solutions to the phase problem. Completing and refinement of crystal structure model. Interpretation of results. Absolute structure determination. Crystallographic information file. Crystallographic databanks. Presentation of results.

Practical instruction: Determination of crystal density. Selection and centering of crystalline specimen. Work on appropriate diffractometer. Use crystallographic programs form solution, refinement and validation of crystal structure models (Rieltveld and Shelx). Use of Cambridge Crystallographic Database. Presentation of the results.

Curriculum Map			
Code #	**NQF Learning Domains And Course Learning Outcomes**	**Course Teaching Strategies**	**Course Assessment Methods**
1.0	**Knowledge**		
1.1	Upon successful completion of this course The student will be able to: • **Describe** the theory of symmetry in crystals, crystallographic computations, X-ray diffraction, non-ideal crystals and tensor properties of solids. • **Apply** crystallographic computational methods on specific scientific questions including its implementation in software. • **Account** for the use of space groups, metrics, crystallographic computations in the description of crystal structures. • **Relate** basic crystallographic theory to given examples of crystal structure problems from literature. • **Reflect** over the connection between basic crystallographic theory and potential scientific uses. • **Give** a presentation of course material within the subject area. • **Discuss** selected literature in relation to the theory covered in the class • **Present** the above goals verbally and in writing in a scientifically clear and correct language	**1-** Demonstrating the basic information and principles through lectures and the achieved applications. **2 -** Discussing phenomena with illustrating pictures and diagrams. **3 -** Lecturing method: Blackboard Power point e-learning **4 -** Tutorials. **5 -** Revisit concepts. **6 -** Discussions. **7 -** Brain storming sessions. **8 -** Start each chapter by general idea and the benefit of it. **9 -** Learn the student background of the subject. **10 -** Show the best ways to deal with the problems. 11- Keep the question "why" or "how" to explain always there.	**1 -** Quizzes and Homework's 20% **2 -** Short exams (midterm exams) 30% 1- **3-** Long exam (final) 50%
1.2			
2.0	**Cognitive Skills**		
2.1	<u>After completing this course:</u>	- Preparing main outlines for teaching.	1) Midterm exam. Exams, short quizzes.

	The student will be: • familiar with the main aspects of the historical development of crystallography as a main method for structure determination. • able to discuss and interpret experiments that reveal the X-ray interaction with crystalline and amorphous materials. • Provide instruction on the methods and basis for determining low-molecular weight crystal structures using X-ray crystallography; • able to use crystallographic databases and crystallographic programs • able to identify crystalline phases • able to determine the content of particular crystal phases in the multiphase sample; • able to determine the microstructural parameters of each present phase; • able to determine the microstructural parameters of each present phase ; • able to determine the influence of thermodynamic, chemical and other parameters on the change in the structure and properties of the materials. • able to use Rietveld method and refine crystallographic parameters of known structures of examined crystalline phases. • able to interpret and understand assessment of the results of crystal structure analysis to be carried out; and to guide students through several actual analyses using the Fulproof or SHELX-program suite implemented on Pentium PC's. • Define, master, and interpret structure and symmetry system .	- Following some proofs. - Define duties for each chapter. - Homework assignments. - Encourage the student to look for the information in different references. - Ask the student to attend lectures for practice solving problem.	2) Asking about physical laws previously taught. 3) Writing reports on selected parts of the course. 4) Discussions of how to simplify or analyze some phenomena.

2.2			
3.0	**Interpersonal Skills & Responsibility**		
3.1	**At the end of the course, the student will be able to:** **1.** Work independently. **2.** The students learn independently and take up responsibility.	1- Learn how to search the internet and use the library. 2- Learn how to cover missed lectures. 3- Learn how to summarize lectures or to collect materials of the course. 4- Learn how to solve difficulties in learning: solving problems – enhance educational skills. 5 - Develop the interest in Science through : (lab work, field trips, ...). 6 - Encourage the student to attend lectures regularly by : - Giving bonus marks for attendance, - Assigning marks for attendance, - Give students' tasks of duties	1. Quizzes on the previous lecture. 2. Discussion. 3. The accuracy of the result gained by each group will indicate the good group work. 4. Presenting the required research on time and the degree of the quality will show the sense of responsibility. .
3.2			
4.0	**Communication, Information Technology, Numerical**		
4.1	**1.** Computation, **2.** Problem solving, **3.** Data analysis and interpretation.	1 - Know the basic mathematical principles and group theories. 2 - Use the web for research. 3 - Discuss with the student. 4 - Exams to measure the mathematical skill.	1. Their interaction with the lectures and discussions. 2. The reports of different asked tasks. 3.Homework, Problem solutions, assignment and exam should focus on the understanding.

		5 - Encourage the student to ask for help if needed. 6 - Computational analysis. 7 - Data representation. 8 - Focusing on some real results and its physical meaning. 9 - Lectures for problem solution. 10 - Encourage the student to ask good questions to help solve the problem. 11 - Display the lecture note and homework assignment on the web.	4. Results of computations and analysis. 5. Comments on some resulting numbers. 6. Research.
4.2			
5.0	**Psychomotor(if any) (NA)**		

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Exercises & Home works	All weeks	% 5
2	Participation	All weeks	% 5
3	In-Class Problem Solving	13th,7th week	10 %
4	Midterm 1	6th week	15 %
5	Midterm 2	12th week	15 %
6	Final Exam	16th week	50 %

D. Student Academic Counseling and Support

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

E Learning Resources

1. List Required Textbooks: 1.1 C. Giacovazzo et al. : Fundamentals of Crystallography, latest edition, Oxford University Press. ISBN-13: 978-0198509585
2. List Essential References Materials (Journals, Reports, etc.) : **1.** Edited by R. A. Young, (1995) The Rietveld method, IUCr monographs on Crystallography, Oxford University Press, Oxford. **2.** Bish, D. L., Post J. E. (Eds.), (1989) Modern Powder Diffraction, Reviews in Mineralogy, Vol. 20, 145 p, Mineral. Soc. America, Michigan.
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. http://www.monash.edu/pubs/handbooks/units/MTE6881.html https://www.ch.cam.ac.uk/analytical/crystallography/ http://www.rgf.bg.ac.rs/predmet.php?menu=about&id=6939&lang=en
4. 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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) • Class room is already provided with data show • The area of class room is suitable concerning the number of enrolled students and air conditioned. • King Abdulah Library (Umm Al-Qura University)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching • 10 minutes Quiz per week. • Home works. • Term paper. • Final Exam.

2. Other Strategies for Evaluation of Teaching by the Instructor or the Department

- At the end of term, Students fill an evaluation Sheet (without names).
- Student Marks are analyzed by considering Standard Deviation.

3. Procedures for Teaching Development

- Strategies are modified each term according to the student feedback.

4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution)

n case of more than one section taken this course, the instructors are cooperated to give unified Exams and they use the same marks distribution for the answer sheet. Students can see their corrected sheet and compare it with key answer sheet.

5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it.

1- The following points may help to get the course effectiveness

- Student evaluation
- Course report
- Program report
- Program Self study

2- According to point 1 the plan of improvement should be given.

3- Contact the college to evaluate the course and the benefit it add to other courses.

4- Add some subject and cut off others depending on the new discoveries in physics.

Name of Course Instructor : Timomi

Signature: …… **Date Completed:** ……

Program Coordinator: Adel Madani

Signature: …… **Date Received:** ……

Course Title: **Characterization techniques**

Course Code: **403635-3**

(M-3)

Date 10-10-2018	**Institution:** Umm Al-Qura University .
College: Faculty of Applied Science	**Department**: Department of physics

A. Course Identification and General Information

1.Course title and code: **Characterization techniques: 403635-3**			
2. Credit hours: **3 hrs**			
3. Program(s) in which the course is offered. **M.Sc. physics** (If general elective available in many programs indicate this rather than list programs)			
4. Name of faculty member responsible for the course, **Prof. Dr. Roshdi Seoudi**			
5. Level/year at which this course is offered: **1st Year / Level 1**			
6.Pre-requisites for this course (if any): **Solid State Physics (403631-3)**			
7. Co-requisites for this course (if any):			
8. Location if not on main campus: **Main campus**			
9. Mode of Instruction (mark all that apply):			
a. Traditional classroom	✓	percentage?	70%
b. Blended (traditional and online)	✓	percentage?	20%
c. E-learning	✓	percentage?	10%
d. Correspondence		percentage?	
f. Other		percentage?	
Comments:			

B Objectives

1. The main objective of this course

The characterization of materials especially their structures, chemical, physical characterization and properties is very important and useful in the area of science so this course gives an overview in many techniques to identify and characterize the new materials.

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

1. Explain the strategy of the course in the beginning of the semester
2. Outlines of the physical laws and principles of each techniques under study.
3. Encourage the students to see more details in the international web sites, published papers and reference books.
4. Renew the course references frequently
5. Frequently check for the latest characterization techniques discovery in science

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

The course gives an overview of the idea, theoretical, main component, and application of many techniques specifically [ultraviolet-visible, Fourier transform infrared, Raman spectroscopy, scanning and transmission electron microscopy (SEM and TEM), scanning tunneling microscopy (STM), atomic force microscopy (AFM) and x-ray diffraction (XRD), I-V characteristic curves for solar cells , which is short for Current-Voltage Characteristic Curves or simply I-V curves of an electrical device, LRC measure; inductance (L), capacitance (C), and resistance (R) are the components of the circuits at various frequencies] to study the structural, chemical, physical characterizations and electrical properties of the new prepared materials. Principles, instrumentation and applications of instruments will be covered. Emphasis will be on developing the ability to solve problems associated with characterization and properties of materials. Particular attention is given to selection criteria used for choosing the appropriate technique specific for characterization of materials and devices.

1 Topics to be Covered

Topic	No of Weeks	Contact hours
1- **Ultraviolet visible spectroscopy (UV-VIS):** It is including basic principle, instrumentation configuration, data interpretation, analysis and studying of the optical properties	**2**	**6**

2- **Fourier-transform infrared spectroscopy (FTIR) and Raman spectroscopy:** It is including basic principle, instrumentation configuration, data interpretation and analysis, and special techniques such as attenuated total reflection (ATR), diffuse reflectance, and Polarization modulation-infrared reflection-adsorption spectroscopy (PM-IRRAS)	**2**	**6**
3- **Scanning electron microscope (SEM):** It is including introduction the basic principle and instrumentation configuration and their strengths and weaknesses	**1**	**3**
4- **The transmission electron microscope (TEM):** It is including the basic principle and instrumentation configuration, the introduction of the electron diffraction and various imaging techniques including high-resolution imaging as well as chemical analysis as performed by both transmission and scanning electron microscopy.	**2**	**6**
5- **Atomic force microscope (AFM):** It is including contact-mode, tapping-mode and lateral-force AFM, scanning tunneling microscope (STM), electrostatic force microscope (EFM), magnetic force microscope (MFM), AFM-based nano-lithography, surface force and adhesion measurement, as well as molecular recognition. Understanding of the required instrumentation and the underlying mechanism of image formation.	**1.5**	**4.5**
6- **X-ray diffraction:** It is used to describe the types of structural information that can be obtained from X-ray scattering: crystallinity, phase identification, crystallite size, orientation, cell parameters for strain and/or chemical information, the thickness of films and multilayers.	**2**	**6**
7- **X-ray photon spectroscopy (XPS):** It is including basic principle, instrumentation configuration, data interpretation and analysis, chemical shift, quantification, and depth-profiling	**1.5**	**4.5**
1.		
8- **The I-V Characteristic Curves**: It is including, basic principle, instrumentation configuration, measuring of data and interpretation of a new materials which operated within an electrical circuit.	**1**	**3**
LCR Meter: It is including, basic principle, instrumentation configuration, measuring the inductance (L), capacitance (C), and resistance (R), impedance (Z), phase angle (θ), dissipation factor (D), quality factor (Q), and equivalent series resistance (ESR) at various frequencies and data interpretation of a new materials which operated within LCR circuit.	**2**	**6**
	15 weeks	**45 hrs**

2. Course components (total contact and credit hours per semester):						
	Lecture	**Tutorial**	**Laboratory/ Studio**	**Practical**	**Other**	**Total**

Contact Hours	Planned	**45 hrs**	**15 hrs**				**60 hrs**
	Actual	**45 hrs**	**15 hrs**				**60 hrs**

3. Individual study/learning hours expected for students per week.	8

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	**NQF Learning Domains And Course Learning Outcomes**	**Course Teaching Strategies**	**Course Assessment Methods**
1.0	**Knowledge**		
1.1	Use modern characterization techniques (microscopic and spectroscopic, and electric circuits) to evaluate and analyze the data measured from these techniques.	1-Theoretical and experimental teaching is supported and identify the structure of the materials. 2-Give the students the summary of course after the end of each chapter. 3-Recommended textbooks, paper, data show, internet.	1- Midterm exams 2- Homework and Activities 3- quizzes 4- Final exam
1.2	Practice how observation, experiment and theory work together in the element analysis, chemical structure analysis, electronic structure and electrical properties measurement, depth profiling, topography imaging, surface and interface analysis.		
1.3	Translate the ability to characterize, electrical properties of the prepared materials, devices by comprehensively utilizing appropriate techniques.		
1.4	Select critical selection decisions; conduct characterization measurements; evaluate, analyze and interpret data		
1.5	Analyze the practical characterization problems by utilizing the techniques, skills, and modern analytical tools.		

2.0	**Cognitive Skills**		
2.1	Construct the course designed so the students can study it in the way that works for them.	1- Asking questions during lectures. 2- Midterm exams and quizzes. 3- Doing homework. 4-Discussion same physical method, check the solution of the problems	1-The exam must contain questions that can measure these skills. 2- Quiz and exams 3- Discussions after the lecture.
2.2	Manage the students to spend between 10 and 15 hours each week on independent study in addition to the timetabled tutorials, including all reading, writing and thinking about the course.		
2.3	Classify unit to take approximately two weeks to study. The units will make the most sense if studied in the order in which they are presented but can be studied in any order.		
2.4	Construct series of review questions designed to let students know whether they have understood a unit, whilst other activities make them draw their learning together.		
2.5	Perform work on the module level activities in parallel with studying the main materials.		
3.0	**Interpersonal Skills & Responsibility**		
3.1	Measure the ability of student and supports them to hard work independently and with groups.	1-Internet websites. 2- Library. 3- Small group discussion.	1-Evaluate the work in a team and presentations. 2-The ability to search through the library and internet to give information on the course. 3-Identification of materials structure.
3.2	Revise his English language.		
	Employ work effectively in groups and exercise leadership when appropriate		
4.0	**Communication, Information Technology, Numerical**		
4.1	Communicate verbally, graphically, and/or in writing the results of theoretical calculations and laboratory experiments in a clear and concise manner that incorporates the stylistic conventions used by physicists worldwide.	1-Homework 2- Seminars presentation	1-Give students tasks to measure their calculations and analysis, problem solving. Encourage students to seek help if necessary. 2-Encourage students to ask a good question to
4.2	Access information on a topic from a variety of sources, and be able to learn new things on one's own.		
4.3	Review the student to use the internet communicates tools.		

			help solve the problem.
5.0	**Psychomotor(if any)**		
5.1	Not applicable.	Not applicable.	Not applicable.
5.2	Not applicable.	Not applicable.	Not applicable.

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Midterm 1	5th week	15 %
2	Midterm 2	10th week	15 %
3	quizzes	During the semester	10%
4	Home works	During the semester	10%
5	Final exam	End of the semester	50%
	Total		100 %

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per 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. (2hrs per week)

E Learning Resources

1. List Required Textbooks

1- "Surface Analysis: The Principal Techniques", John C. Vickerman, Ian Gilmore, 2nd Edition, John Wiley & Sons, Inc., (2009), ISBN: 978-0470017647
2- "Organic Structural Spectroscopy" by Joseph B. Lambert, Herbert F. Shurvell, David A Lightner, Robert Graham Cooks, Prentice Hall; 1st edition, (1997), ISBN: 0132586908
3- 'Fundamentals of light microscopy and electronic imaging' Douglas B. Murphy, 2001, Wiley-Liss, Inc. USA
4- 'Encyclopedia of Materials Characterization, Surfaces, Interfaces, Thin Films,' Editors C. Richard Brundle, Charles A. Evans, Jr., Shaun Wilson, Butterworth-Heinemann, Boston, US

5- Elements of X-ray diffraction' B.D. Cullity and S.R. Stock, 2001, Prentice Hall, Inc. USA
6- 'Transmission electron microscopy" D.B. Williams and C. Barry Carter, 4 volumes, Springer, 1996. USA
7- 'Handbook of low and high dielectric constant materials and their applications' Hari Singh Nalwa (ed.), 1999, London, Academic Press, ISBN 0 12 5139071 and ISBN 0 12 5139063
8- Electrical Properties of Materials, by L. Solymar, D. Walsh, , (2004) Oxford University Press, Seven edition, ISBN-13: 978-0199267934

2. List Essential References Materials (Journals, Reports, etc.)

1- "Surface Analysis Methods in Materials Science" by D.J. O'Connor, Brett A. Sexton, Roger S. C. Smart, Springer; 2 edition, (2003), ISBN: 3540413308
2- Organic Spectroscopy, by Lal Dhar Singh Yadav, Springer; 1 edition, (2005), ISBN: 1402025742
1. (Surface and Thin Film Analysis: A Compendium of Principles, Instrumentation, and Applications" by Henning Bubert, Holger Jenett, Wiley-VCH, (2002), ISBN: 3527304584
2. "Scanning Probe Microscopy: The Lab on a Tip" by Ernst Meyer, Hans J. Hug, Roland Bennewitz, Springer, (2003), ISBN: 3540431802.
3. "Handbook of Surface and Interface Analysis, by John C. Riviere, CRC; 1 edition, (1998), ISBN: 0824700805
4. "Structure Determination of Organic Compounds: Tables of Spectral Data", by E. Pretsch, P. Bühlmann, C. Affolter, Springer; 3 edition, (2004), ISBN: 3540678158
5. Practical Guide to Surface Science and Spectroscopy by Yip-Wah Chung, Academic Press, (2001), ISBN: 0121746100

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

1. http://www.nanotech-america.com/dmdocuments/mironov_book_en.pdf

4. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

There are so many computer programs that can be used for analyses the materials using a specific program for each technique.

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.)

1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)

Lecture room and a board is suitable concerning the number of enrolled students

2. Technology resources (AV, data show, Smart Board, software, etc.)

Data show, Smart Board, software of many techniques is available in the department

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

1-Questionaries'
2-Open discussion in the class room at the end of the lectures

2. Other Strategies for Evaluation of Teaching by the Instructor or the Department

1-Revision of student answer paper by another staff member.

2-Analysis the grades of students.
3. Procedures for Teaching Development 1- Course report 2-Program report and Program self-study and a tutorial lecture
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) After the agreement of Department and Faculty administrations
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. Periodical revision by Quality Assurance Units in the Department and institution

Name of Course Instructor: **Prof. Roshdi Seoudi**

Signature: **Date Completed: 11/10/2018**

Program Coordinator: Prof. Adel-Madani

Signature: _____ **Date Received: _____**

Course Title : Physical Properties of Solid Materials

Course code : 403637-3

(M-4)

Date : 19-10-2018	Institution: Um AL – Qura University
College : Faculty of Applied Science	Department : Physics

A. Course Identification and General Information

1. Course title and Code : Physical Properties of Solid Materials - 403637-3

2. Credit hours : 3hrs.

3. Program(s) in which the course is offered. **M.Sc. in 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 academic staff member**

5. Level/year at which this course is offered : **1st Year / Level 2**

6. Pre-requisites for this course (if any) : Solid State Physics **403631**

7. Co-requisites for this course (if any) :

8. Location if not on main campus : **Main campus**

9. Mode of Instruction (mark all that apply) :

a. Traditional classroom	✓	percentage?	80
b. Blended (traditional and online)	✓	percentage?	10
c. E-learning	✓	percentage?	10
d. Correspondence		percentage?	
f. Other		percentage?	

Comments:

B. Objectives :

1. Summary of the main learning outcomes for students enrolled in the course. The objective of this course is to study the physical properties as electrical, magnetics, optical, mechanical, and thermal that govern the operation of conventional devices.
2. Describe briefly any plans for developing and improving the course that are being implemented. (eg increased use of IT or web based reference material, changes in content as a result of new research in the field) **1.** Explain strategy of the course in the beginning of the semester **2.** Outlines of the physical properties concepts, theories and the associated proofs. **3.** Highlighting the day life applications whenever exist. **4.** Encourage the students to see more details in the international web sites and reference books in the library. **5.** Discussing some selected problems in each chapter. **6.** Cooperate with different institution to find how they deal with the subject **7.** Frequently check for the latest discovery in material science

C. Course Description: (Note : General description in the form used in the program's bulletin or handbook).

Course Description: The course gives the theoretical approach of the physical properties of the materials such as physical , thermal, electrical, optical, magnetic, dielectric etc.

1 Topics to be Covered :		
List of topics :	**No of Weeks**	**Contact hours**
INTRODUCTION TO PHYSICAL PROPERTIES.	2	6

ELECTRICAL PROPERTIES: 9- Electrical conduction in solids 10- Breakdown of the classical theory of conduction & introduction to the quantum theory and its predictions. 11- Quantum model of electrical conduction in metals; alloying effects; effect of temperature on conductivity. 12- Transport theory in solid materials. 13- Electrical conduction in non-crystalline materials. 14- The combined role of the band gap and temperature on conductivity. - Simple intrinsic semiconductor devices - Extrinsic semiconductors: doping - donor and acceptor atoms; - conductivity equations; - effect of temperature on conductivity - freeze-out curves. 15- Introduction to band-gap engineering 16- Defects theory in solid materials	3	9
ELECTROMAGNETIC PROPERTIES: 6- Basic concepts of magnetism: dipole moment and the Bohr magneton; magnetic susceptibility; magnetic induction; saturation magnetization. 7- Types of magnetic behaviour: diamagnetism; paramagnetism; ferromagnetism; anti ferromagnetism; ferrimagnetism 8- Modern theories of ferri/ferromagnetism; exchange interaction; effect of temperature on saturation magnetization (Curie and Neel temperatures) 9- Magnetic domains and Bloch walls. Generation of hysteresis loops and the definition of soft/hard ferri/ferromagnets. Magnetic anisotropy and magnetostriction. 10- Basic ferromagnetic and ferromagnetic devices such as memory devices; electrical motors, computer hard disks, transformers etc. 11- Superconductivity: Type I and II superconductors; concept of the critical temperature; high-temperature superconductors. 12- Types of superconducting materials (metals and alloys, intermetallics, polymers & ceramics). 13- BCS theory of superconductivity; effects of electrical and magnetic fields on superconductivity; Meissner effect. 14- Superconducting devices.	4	12

THERMAL AND OPTICAL PROPERTIES: 6- Thermal properties of materials: classical and quantum theories of heat capacity. 7- Thermal expansion. Thermoelectricity and the Seebeck effect.. 8- Optical properties of materials: interaction of radiation with matter; reflectivity. 9- Optical devices (lasers, modulators, switches, waveguides, optical fibres, blue ray disks) 10- Optical properties of nanomaterials	3	9
MECHANICAL PROPERTIES: 5- Stress-strain diagram ,Young modulus, Poisson ratio, Shear modulus 6- Plastic tensile test 7- Dislocation **8-** Hardness and roughness	3	9
Total :	15 weeks	45 hrs

2 Course components (total contact hours per semester):

Lecture : 45 hrs	**Tutorial : 15 hrs**	**Lab :**	**Total : 60 hrs**

3. Individual study/learning hours expected for students per week. (2h)

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

For each of the domains of learning shown below indicate:

- A brief summary of the knowledge or skill the course is intended to develop;
- A description of the teaching strategies to be used in the course to develop that knowledge or skill;

Code #	NQF Learning Domains and Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Recognise fundamentals in electronic and atomic structure of solids.		-Midterm theoretical exams

1.2	Understand the models and theories, which explain the physical properties.	-Explain key concepts; formulate mathematical models and nurture analytical skills. -Provide numerical examples and solutions of advanced problems in solid state physics .	-Homework and Activities -quizzes
1.4	Understand the structure of crystalline solids: crystal axes and planes, lattices and defects.		
1.5	Understand microscopic and macroscopic electrical , magnetic , optical and thermal properties of solids		
2.0	**Cognitive Skills**		
3.0	**Interpersonal Skills & Responsibility**		
4.0	**Communication, Information Technology, Numerical**		
5.0	**Psychomotor (if any)**		
5.1	Not applicable.	Not applicable.	Not applicable.
5.2			

5. Assessment Tasks Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Midterm 1	5th week	15%
2	Midterm 2	10th week	15%
3	Online quizzes	every week	10%
4	Homework	Every week	5%
5	Interactive discussions	Every week	5%
6	Final exam	End of semester	50%
	Total		100 %

D. Student Academic AND Counselling Support

E. Learning Resources

List Required Textbooks:

Text book :

1) Physical Properties of Materials, Second Edition Mary Anne White (2011) Publisher: CRC Press (1642) ASIN: B01K0TTZ3I
2) W. D. Callister, Jr., "Materials Science and Engineering, An Introduction" Wiley - 8th Edition (2013) ISBN-13: 978-1118324578
3) S. O. Kasap, "Principles of Electronic Materials and Devices," McGraw Hill, 3rd edition (2017) ISBN-13: 978-0078028182
4) Electronic Properties of Materials Hummel, Rolf E. 4th ed. Springer. (2011) ISBN: 978-1441981639

Recommended Reading List :

1) The Structure and Properties of Materials: Volume IV – Electronic Properties: R. M. Rose, L. A. Shepard and J. Wulff, John Wiley and Sons, 1966.
2) Lectures on the Electrical Properties of Materials: L. Soymar and D. Walsh, Oxford, 1988.
3) An Introduction to the Electron Theory of Solids: J. Stringer, Pergamon, 1967.
4) Introduction to the Modern Theory of Metals: A. Cottrell, Institute of Metals, London, 1988.
5) Physics of Solids: C. A. Wert and R. M. Thompson, McGraw-Hill, 1964.
6) Introduction to solid State Physics: C. Kittel, John Wiley and Sons, 1986.
7) Electronic Properties of Crystalline Solids: R. H. Bube, Academic Press, New York, 1974.
8) Solid State Theory in Metallurgy: P. Wilkes, Cambridge University Press, 1973.
9) Solid State Electronic Devices: B.G. Streetman, Prentice-Hall, 1980.
10) Magnetic Materials: R. S. Tebble and D.J. Craik, Wiley Interscience, 1969.
11) Electronic process in Non-crystalline Materials, N.E Mott and E.A.Davis , Oxford classic texts in physical sciences , 2012

Electronic Materials, Web Sites

http://www.physicalpropertiesofmaterials.com/student

Other learning material such as computer-based programs/CD, professional standards / regulations

- Power points (use e-learning gate of Umm Al-Qura university)
- Youtube videos (use e-learning gate of Umm Al-Qura university)

F. Facilities Required :

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

1. Accommodation (Lecture rooms, laboratories, etc.)

- Class room is already provided with data show
- The area of class room is suitable concerning the number of enrolled students and air conditioned.
- Lab with for 20 students

2. Computing resources

- Providing class rooms with computers and labs with data show.

3. Other resources (specify, eg. If specific laboratory equipment is required, list requirements or attach list)

G. Course Evaluation and Improvement Processes

1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching :

- Questionaries (using of e-learning gate of Umm Al-Qura university)
- Online Quizzes (using of e-learning gate of Umm Al-Qura university)
- Open discussion (using of e-learning gate of Umm Al-Qura university)

1. Other Strategies for Evaluation of Teaching by the Instructor or by the Department :

- Revision of student answer paper by another staff member if evaluable
- Analysis the grades of students.

2. Processes for Improvement of Teaching :

- Preparing the course as PPT.
- Using scientific movies.
- Coupling the theoretical part with laboratory part
- Periodical revision of course content.

3. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution)

- After the agreement of Department and Faculty administrations
- 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.

5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

1- The following points may help to get the course effectiveness
   - Student evaluation
   - Course report
   - Program Self study
   - E-learning
2- According to point 1 the plan of improvement should be given.
3- Contact the college to evaluate the course and the benefit it add to other courses.

Add some subject and cut off others depending on the new discoveries in physics.

Name of Constructor : Dr. Abdelmajid TIMOUMI

Signature : ……. **Date completed:** 19/ 10/2018

Program Coordinator : Prof Adel-Madani

Signature : …….. **Date received:**…….

Course Title: Renewable energy

Course Code: 403624-3

(M-5)

Date: 2018-10-20	**Institution:** Umm Al-Qura University .
College: Faculty **of** Applied Science	**Department:** Physics

A. Course Identification and General Information

1. Course title and code: New and renewable energy (**403642-3**)		
2. Credit hours: 3 hrs		
3. Program(s) in which the course is offered : MSc 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 academic staff member**		
5. Level/year at which this course is offered: **level 3 / 1st year**		
6. Pre-requisites for this course (if any): Solid State Physics **403631-3**		
7. Co-requisites for this course (if any):		
8. Location if not on main campus: Main Campus		
9. Mode of Instruction (mark all that apply):		
a. Traditional classroom	X	percentage? 75
b. Blended (traditional and online)	X	percentage? 10
c. E-learning	X	percentage? 5
d. Correspondence		percentage?
f. Other	X	percentage? 10

Comments: External Manufacturing visits are also available

B Objectives

1.The main objective of this course

The aim of the Renewable Energy courses in the MSc (Material Science Track) is to :

1. Understand the various forms of conventional energy resources.
2. Learn the present energy scenario and the need for energy conservation
3. Explain the concept of various forms of renewable energy
4. Outline division aspects and utilization of renewable energy sources for both domestics and industrial application
5. Analyze the environmental aspects of renewable energy resources.
6. Produces graduates with a mix of skills which are tailored to the renewable energy technology methods.
7.Provide a qualification that meets high Level of the Framework for Higher Education Qualifications.

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

New and renewable energy course provides an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternate energy sources and their technology and application. The class will explore society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternate, renewable energy sources such as solar, biomass (conversions), wind power, geothermal, and hydro. Energy conservation methods will be emphasized and Fuel cells technologies.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

1. Topics to be Covered		
List of Topics	**No. of Weeks**	**Contact hours**
Introduction to Renewable Energy Technology	1	3
Energy Shortage and Fossil Fuel - Coal . Petroleum. Natural Gas . Hydrocarbon Conversion . Fossil Fuel Summary	1	3
Basics on Solar Energy -Description of the solar Spectrum . Black body . Wien Law Stefan Effect and energy lost. Existing Energy Technologies	1	3

Global Worming and Greenhouse Effect - Albedo and the Greenhouse Effect . Atmospheric Physics . Global Energy Flow . CO2 and the Carbon Cycle. Feedbacks and Climate Modeling	1	3
Solar Radiation Distribution over the world	1	3
Solar Energy **Photovoltaics .** Introduction to solar energy, solar geometry, photovoltaic effect, Solar cell technology, photovoltaic generators technologies, photovoltaic systems autonomous/interconnected. **Solar thermal applications.** Solar thermal power systems (household, centralized), Energy generating systems, thermal energy storage. Photovoltaic Energy. Thermal Energy. Solar Concentrators	2	6
Wind Energy Introduction to wind energy. The Nature of the Wind . Characterization of a Wind Resource . The Potential of Wind Energy. Wind Turbines. Wind characteristics, Wind energy potential, Types of wind turbines, wind farms.	1	3
Biomass Introduction to biomass, biomass potential, exploitation possibility, cogeneration.	1	3
Hydropower Introduction to hydropower, Small hydropower systems, system resources, hydroelectric power plants technologies. Fuel cell technology	2	6
Geothermal Energy Introduction to geothermal energy, geothermal fields, space heating, electricity generation, shallow geothermal energy systems	1	3
Other form of renewable energy Tidal power, wave power.	1	3
Energy storage -Performance Criteria for Energy Storage , Grid-scale Storage -Mobile Energy Storage . Other Energy Storage Systems	1	3
Efficient Energy Use and Thermal Building Optimization -First Law Efficiency , Second Law Efficiency , Example: The Efficiency of Space Heating , Exergy , Efficiency and Conservation Case Studies Energy Systems: Scales and Transformations	1	3
Total	15	45

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	45 hrs			10 hrs		55 hrs
	Actual	45 hrs			10 hrs		55 hrs
Credit	Planned	45 hrs			10 hrs		55 hrs
	Actual	45 hrs			10 hrs		55 hrs

3. Individual study/learning hours expected for students per week. 8

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

On the table below are the seven 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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	On completing the program students should be able to: **Recognize** knowledge and understanding of current worldwide energy usage and its impact on climate.	-Theoretical and experimental teaching is supported . -Give the students the summary of course after the end of each chapter.	-exams -Homework -quizzes
1.2	**describe** a comprehensive knowledge and understanding of the origins and distribution of different renewable energy sources (solar, wind, hydro, wave, tidal and bioenergy).		
1.3	**relate** a comprehensive knowledge and understanding of the storage/conversion and integration of these renewable energy sources into existing systems.		

1.4	understand the operation and control principles of electrical power distribution networks.	-Recommended textbooks, paper, data show, internet.	
1.5	understand the roles of different energy sources in the provision of a national electricity supply.		
2.0	**Cognitive Skills** On completing the program students should be able to:		
2.1	**Evaluate** current research and methodologies in renewable energy production , conversion and storage.	Discussion same physical method, check the solution of the problems	Exams
2.2	**Demonstrate** originality in identifying and considering problems of sustainable energy sources .		
2.3	**Produce** and critically appraise renewable energy solutions.		
2.4	**Deal** with complex issues both systematically and creatively.		
2.5	**Make** sound judgments in the absence of complete data.		
2.6	**Review** options and make decisions while considering a range of issues including technical, financial, environmental and policy.		
2.7	Use appropriate software packages and IT skills for modelling and simulation of renewable energy systems.		
2.8	Quantify resource potential and determine the appropriate renewable energy resource at a given site.		
2.9	Analyze the energy capture potential for solar, wind & hydro resources.		
2.10	Demonstrate practical measuring and auditing skills.		
3.0	**Interpersonal Skills & Responsibility** On completing the program students should be able to demonstrate:		
3.1	critical awareness of theoretical design concepts and their practical implementation within renewable energy systems.		
3.2	**The ability** to work independently for continuing professional development.		
3.3	**The ability** to understand basic concepts such as power production, efficiency, energy yield of various renewable energy systems for a specific site.		
3.4	**The ability** to describe the main design concepts, main differences, advantages of various renewable energy systems		

3.5	**The control** of Time and resource planning and management.		
4.0	**Communication, Information Technology, Numerical**		
4.1	Intellectual skills are taught primarily through design classes, case studies and seminars. Development of these skills is particularly linked to industrial applications such as group and individual design exercises, post school assignments and the lab course.	- Seminars - presentation	
5.0	**Psychomotor (if any)**		
5.1	Not applicable.	Not applicable.	

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Midterm 1	5th week	15 %
2	Midterm 2	10th week	15 %
3	quizzes	During the semester	10%
4	Home works	During the semester	10%
5	Final exam	15th week	50%
	Total		100%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per 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. (2hrs per week)

E Learning Resources

1. List Required Textbooks

1. Renewable and Efficient Electric Power Systems. Masters, G. (2004). Wiley Interscience.
2. The Physics of Energy . Robert L Jaffe and Washington Taylor Cambridge University Press, 2018 ISBN 978-1-107-01665-1 Hardback
3. Physics of Energy Sources. Manchester physics series. George C. King, 1st edition
    a. Editor Wiley 2014

4. Energy for a sustainable world: from the oil age to a sun-powered future, Armaroli N. and Balzani V Wiley-VCH.
5. Energy and the Environment, Ristinen R.A. , Kraushaar J.J. Wiley.
6. Messenger, R., & Ventre, J. (2010). Photovoltaic Systems Engineering. CRC Press.
7. Patel, M. (2006). Wind and Solar Power Systems. Taylor and Francis.
8. Yildiz, F., & Coogler, K. (2010). Development of a Renewable Energy Course for a Technology Program. ASEE Annual Conference and Exposition.

2. List Essential References Materials (Journals, Reports, etc.)

- Renewable and Efficient Electric Power Systems, Master G. M., John Wiley & Sons, Inc.

- Energy: Physical, Environmental and Social Impact, Aubrecht G. J., Pearson Prentice Hall.

- Emissions Trading: Principles and Practice, Tietenberg T. H. Washington D.C.: Resources for the Future Press.

3.List Electronic Materials, Web Sites, Facebook, Twitter, etc.

http://www.microbot-ed.com/ExpRenewNRG1_0.pdf

4. 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.)

1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)

2.Technology resources (AV, data show, Smart Board, software, etc.)

Data show, Smart Board, software of many techniques is available in the department

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

-Questionaries'
-Open discussion in the class room at the end of the lectures

2. Other Strategies for Evaluation of Teaching by the Instructor or the Department

-Revision of student answer paper by another staff member.
-Analysis the grades of students.

3.Procedures for Teaching Development: Students are encouraged to develop their knowledge and understanding by independent reading, for which they are given guidance in the distance learning/self guided material, use of the internet and discussing the subjects with their industry based colleagues and/or other students as well as teaching staff.

4.Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) After the agreement of Department and Faculty administrations
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. Periodical revision by Quality Assurance Units in the Department and institution.

Name of Course Instructor: Prof. Adel MADANI

Signature: _____ **Date Completed:** _____

Program Coordinator: Prof. Adel Madani

Signature: _____ **Date Received:** _____

Course Title: **Nanotechnology in Medicine**

Course Code: 403628-3

(M-6)

Date: 20....-.....-.....	**Institution**: Umm AQura University
College: .... Applied Sciences College....	**Department**: .....Physics Department.....

A. Course Identification and General Information

1. Course title and code: Nanotechnology for Biomedical Applications
2. Credit hours: 3 hours
3. Program(s) in which the course is offered. Postgraduate Medical Physics Program

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course
5. Level/year at which this course is offered: **2nd year/ Level 3**
6. Pre-requisites for this course (if any): Solid State Physics (**403631**)
7. Co-requisites for this course (if any):
8. Location if not on main campus: Abdeia Campus – Alzahr Campus
9. Mode of Instruction (mark all that apply):

a. Traditional classroom	√	percentage?	50
b. Blended (traditional and online)	√	percentage?	20
c. E-learning	√	percentage?	20
d. Correspondence	√	percentage?	10
f. Other		percentage?	

Comments:

B Objectives

1. The main objective of this course

- Describe the physics principles underlying the fundamentals of microfabrication.
- List, in words, merits and drawbacks of nanomedicine and Nano biosensors.
- Demonstrate an understanding of and apply nanofabrication of biological systems
- Compare the different methods of biosensors applications in different biological systems.
- Demonstrate an understanding of aspects of clinical applications of bio nanomedicine

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

To improve the students' expert in the nanotechnology field for medical applications:

- Cooperate with external organization to practice synthesis of nanotechnology materials for different medical applications.
- Encourage students to register to webinars and workshops related to the synthesis and characterization of nanotechnology field for different medical applications
- Encourage students to write frequently report about selected research topics related to the field

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description: Nanotechnology is a multi-disciplinary field. It has an innovative applications in both medical imaging and therapy. This course is designed to introduce the students to the world of nanotechnology and its medical applications. It focuses on the different applications of nanoparticles in medical and research level, since nanoparticles can enhance the most of the medical imaging modalities in addition to greatly increasing the targeting and effectiveness of therapy.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Fundamentals of Micro Fabrication: Photolithography - Deposition, and Selective Etching - Thin Film Growth and Deposition - Diffusion and Dopants - Atomic Layer Epitaxy - Soft Lithography. Self-assembled organized systems: Dendrimers, Liposomes, Vesicles, Supramolecular Complexes, Langmuir Blodgett films. Atomic Force Microscopy (AFM)	4	12
Micro Fluidic Pattering and Biopolymer Pattering: Fundamentals of Laminar Fluids Micro Fluidic Processes - The Role of Micro-Scale Fluid Dynamics in BioMEMS Neuro MEMS - Microelectrodes and Neuronal Interfaces, Microstereolithography	3	9

Nanofabrication: Molecular Engineering and Quantum Dots, Nanoscale Structures as Biological Tags and as Functional Interfaces with Biological Systems	2	6
Nano-Biotechnology: Nanoparticles and Microorganisms, Nano-materials in Bone Substitutes and Dentistry, Nanoparticles in medical imaging modalities, Drug delivery and its applications.	3	9
Nanobiosensors: Biochips and analytical devices, Biosensors Nanomedicine, Nanobiosensor, Nanofluidics, Nanocrystals in Biological Detection, Electro-chemical DNA Sensors, Integrated Nanoliter Systems. Clean rooms practice and environmental issues; Applications.	3	9
	15 weeks	45 hrs

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	45 hrs					45 hrs
	Actual	45 hrs					45 hrs
Credit	Planned	45 hrs					45 hrs
	Actual	45 hrs					45 hrs

3. Individual study/learning hours expected for students per week. 8

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods

1.0	**Knowledge**		
1.1	List nanofabrication techniques used with biological systems	1. Lectures 2. Tutorials 3. Individual Assignment 4. Discussions	a) Short exams b) Long exams (final) c) Discussions during the lectures. d) Home work. e) Write a Report
1.2	Recognize nanoparticles chracteristics in different medical applications		
1.3	Outline the different types of nanobiosensor and its applications		
2.0	**Cognitive Skills**		
2.1	The ability to explain the different types of nanofabrication	1. Web-based activities 2. Individual and Group Assigments 3. Group Discussions	a) Aissgnments included some open end tasks b) Web-based project c) Homework d) Final exam e) Short exams f) seminars
2.2	The ability to analyze merits and drawbacks of different types of biosensors and their applications		
2.3	The ability to differentiate between micro fluidic pattering and biopolymer pattering and their applications.		
3.0	**Interpersonal Skills & Responsibility**		
3.1	Write an essay about the requirements of nanoparticles' fabrication used in drug delivery and therapy.	1. Writing an essay 2. Presentations in some selected topics 3. Small Group Discussion. 4. Visits to nanotechnology research laboratory to Improve Students' Expert in Field	a) Essay (Group Assessment) b) Presentations (individual and Group Assessment) c) Homework d) Final exam e) Report in field (Individual Assessment
3.2	Choose the appropriate nanoparticles for different medical imaging modalities.		
4.0	**Communication, Information Technology, Numerical**		
4.1	Demonstrate the use of nanoparticles in different medical imaging modalities.	1. Group Discussions 2. Reports 3. Presentations	a) Essay (Group Assessment) b) Presentations (individual and Group Assessment c) Report in field (Individual Assessment)
4.2	Illustrate the Protocol of using nanoparticles in drug delivery to enhance the targeting and effectiveness of therapy.		
5.0	**Psychomotor(if any)**		
5.1	N/A	N/A	N/A

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Quizes	All week	10%
2	Midterm exams	5th week	15%
3	Oral presentations/ seminars	7th week	15 %
4	Essay/research report	12th week	10%
5	Final written exam	15th week	50%
	Total		100%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) 2hrs/week

E Learning Resources

1. List Required Textbooks - Gabriel A. Silva, **Nanotechnology for biology and medicine**, 1st Ed., Springer, 2012.
2. List Essential References Materials (Journals, Reports, etc.) - Michael Koch, Alan Evans, Arthur Brunnschweiler, **Micro fluidic Technology and Applications (Micro technologies and Microsystems Series)**, 1st Ed., CRC Press; London, 2001. - Eugene J. Koprowski, Gene Koprowski, **Nanotechnology in medicine: Emerging applications**, Mcgraw-Hill Education, 2011 - Sarah Hurst Petrosko and Emily S. Day. **Biomedical Nanotechnology**,.2nd Eds., Springer, 2017
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. • https://www.nano.gov/nanotech-101/what/definition • http://iopscience.iop.org/journal/0957-4484
4. 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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) There is enough classrooms with a good accomodation
2. Technology resources (AV, data show, Smart Board, software, etc.) Computers with simulation software and a good access to internet are required for web-based projects
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching • Course reports • Course evaluation

2. Other Strategies for Evaluation of Teaching by the Instructor or the Department
   - Revision of student answer paper by another staff member.
   - Analysis the grades of students.

3. Procedures for Teaching Development
   - Instructors, who teach the course, have regualer meeting to update the course materials and activities

4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution)
   - 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..
   - Evaluation by the accreditation committee in the university.

5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it.

4- The following points may help to get the course effectiveness
   - Student evaluation
   - Course report
   - Program report
   - Program Self study

5- According to point 1 the plan of improvement should be given.

Name of Course Instructor: Hanan Amer

Signature: _____ Date Completed: _____

Program Coordinator: Taha El-Fawal

Signature: _____ Date Received: _____

Optics and Photonics track

Course Title: **Advanced optics**

Course Code: **403621**-3

(O-1)

Date: 27/9/2018	**Institution:** Umm AL – Qura University
College: College of Applied Science	**Department:** Department of Physics

A. Course Identification and General Information

1. Course title and code: **Advanced optics (code: 403621)**			
2. Credit hours: **3Hrs**			
3. Program(s) in which the course is offered. **Master of Physics;** (If general elective available in many programs indicate this rather than list programs)			
4. Name of faculty member responsible for the course **Mohamed Boustimi**			
5. Level/year at which this course is offered: **1st Year / Level 2**			
6. Pre-requisites for this course (if any):			
7. Co-requisites for this course (if any):			
8. Location if not on main campus: **Main campus and Alzaher**			
9. Mode of Instruction (mark all that apply):			
a. traditional classroom	✓	What percentage?	90
b. blended (traditional and online)		What percentage?	
c. e-learning	✓	What percentage?	10
d. correspondence		What percentage?	
f. other		What percentage?	
Comments:			

B Objectives

1. The main objective of this course

The course aims providing basic as well as advanced topics in optical science (with elementary physical and engineering applications) that are not usually covered in previous physics courses.

Objectives of the class are:

1- Laying down the foundations of the understanding the most fundamental laws and principles of optics; along with their application.
2- Studying fundamental properties of light propagation and interaction with matter under the approximations of geometrical optics and scalar wave optics.
3- Using optical techniques such as holography and Fourier transform for information processing.
4- Emphasis on physical intuition and underlying mathematical tools.
5- Application of physical concepts to topical engineering domains.

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

1- Collaborate with other educational institutions to reveal how they deal with the subject.

2- Renew and update the course references periodically.

3- Frequently check the latest discovery in science to improve the course objectives.

4- Posting some course material on the websites to help the students.

5- Assigning presentations to students to improve their research skills.

6- Focusing on generic skills.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

This advanced course on optics is proposed to bridge the gap between the usual course at BSc. level and the modern applications of optics in spectroscopy and Optical Information Processing. It covers the fundamental properties of light interaction with matter under the approximations of geometrical and scalar wave optics, intermediate topics of electromagnetic optics, optics of anisotropic media, fundamentals of light beam propagation and elements of Fourier optics, including concepts of digital holography.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours

❖ **Geometrical Optics:** Basic concepts, Geometrical light rays, Fermat's Principle of least time, Ray-tracing, Perfect and real optical systems, aberrations, lens design, apertures and stops, radiometry, photometry.	**2**	**6**
❖ **Wave optics:** Huygens principle, Basic electrodynamics, Connection of EM wave to geometric optics, Eikonal Equations: Path of Light in an Inhomogeneous Medium, polarization, interference, wave-guiding, Fresnel and Fraunhofer diffraction, image formation, resolution, and space-bandwidth product.	**3**	**9**
❖ **Anisotropic media:** Susceptibility of an anisotropic media, Wave propagation, normal modes, index ellipoid, Effective refraction index, Distortion of the index ellipsoid, Optical activity and Faraday Effect, Pockels effect, Optics of liquid Crystals, Polarization devices, Electro-optics of anisotropic media, Electro-optic effects in liquid crystals, Photorefractive materials, Electroabsorption.	**3**	**9**
❖ **Beam Optics:** Angular spectrum of plane waves, Field propagators, Helmholtz equation, Gaussian Beams, Description and properties, Transmission through a thin lens, Other solution of Helmholtz equation, Short duration beams, Alternate method for describing a beam: covariance matrix.	**3**	**9**
❖ **Fourier Optics:** Fourier Transform (FT) of some functions, Decomposition and Wave Packets, Convolution and correlation between two functions, Hamonic analysis of a signal, Amplitude and phase modulations, Linear systems, Impulse response, Transfer function, Coherent optical processing, Optical transfer function, Diffraction & Interference, Image shaping, Holography.	**4**	**12**
	15 weeks	**45 hrs**

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	**30**	**15**	**0**	**0**	**0**	**45**
	Actual	**30**	**15**	**0**	**0**	**0**	**45**

Credit	Planned	2	1	0	0	0	3
	Actual	2	1	0	0	0	3

3. Individual study/learning hours expected for students per week.	**6**

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Recall basic principles and concepts of geometric Optics and their related optical phenomena.	**1.** Lectures. **2.** Discussions **3.** Slides and computer simulation software may be used by the teachers to clarify concepts. **4.** Problems solving **5.** Students may be asked to solve some problems on computer using MATLAB language.	**1-** Home work assignments. **2-** Group Project assignment. **3-** Question – answer session in class. **4-** Exams: quizzes, Mid-term and final exams
1.2	Describe fundamental properties of light propagation and interaction with matter under the approximations of geometrical optics and scalar wave optics.		
1.3	Outline facts, principles and concepts of light propagation in anisotropic media and state the related optical phenomena.		
1.4	Describe optical beam propagation in free-space and through various optical components.		

1.5	Recognize optical techniques such as holography and Fourier transform for information processing.		
2.0	**Cognitive Skills**		
2.1	Reorganize how to apply the knowledge acquired to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.	**1.** Lectures. **2.** Discussions. **3.** Problems solving. **4.** Encourage the student to look for the information in different references. **5.** Ask the student to attend lectures for practice solving problem.	**1-** Home work assignments. **2-** Group Project assignment. **3-** Question – answer session in class. **4-** Exams: quizzes, Mid-term and final exams
2.2	Develop and justify knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context.		
2.3	Explain the fundamentals of image formation, of the propagation of light waves and beams through different media and of Fourier Optics.		
2.4	Capacity for predict, calculate, analyse and interpret quantitative results in all related areas.		
3.0	**Interpersonal Skills & Responsibility**		
3.1	Show responsibility for self-learning to be aware with recent developments in physics	**1.** Ask the students to search the internet and use the library. **2.** Encourage them how to attend lectures regularly by assigning marks for attendance. **3.** Small group discussion. **4.** Give students tasks of duties **5.** Discussion in class	**1.** Evaluate the scientific values of solutions. **2.** Evaluate the work in team **3.** Evaluation of the role of each student in group Project assignment **4.** Evaluation of student's presentations. **5.** Direct contact during office hours.
3.2	Show the ability to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.		
3.3	Communicate effectively with peers.		
3.4	Being aware how companies are organised and the principles that govern their activity, and being able to understand employment regulations and the relationships between planning, industrial and commercial strategies, quality and profit.		
4.0	**Communication, Information Technology, Numerical**		

4.1	Demonstrating capability in performing research as well as an effective oral and written communication.	**1.** Communicate effectively in writing, orally and through scientific diagrams. **2.** Preparing a report on some topics related to the course depending on web sites.	1. Evaluation of presentations 2. Evaluation of reports & Project assignment.
4.2	Achieving a level of spoken and written proficiency in English, that meets the needs of the profession and the labour market.		
4.3	Acquire a working knowledge of basic research methodologies, data analysis and interpretation.	**1.** Independent study. **2.** Problem solving.	**1.** Homework **2.** Assignments.
4.4	Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.	**1.** Oral Presentations. **2.** Problem solving. **3.** Independent study.	**2.** Performance in problem solving. **3.** Homework. **4.** Assignments.
4.5	Use of the internet to research solution for relevant scientific problems.	**1.** Independent study.	**1.** Performance in problem solving. **2.** Assignments
4.6	Demonstrate enough knowledge in evaluating published works.	**1.** Independent study.	**1.** Performance in problem solving. **2.** Assignments.
5.0	**Psychomotor(if any)**		
5.1	N/A	N/A	N/A
5.2			

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Exercises & Home works	At the end of each chapter	10%
2	Participation in activities during lectures	All weeks	10%

3	Practical group projects	At the end of each chapter	10%
4	1st Periodic Exam	8th week	10%
5	2nd Periodic Exam	11th week	10%
6	Final Exam	16th week	50%
7			
8			

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) Students are supervised by academic advisers in physics Department and the time tables for academic advices were given to the student each semester. (8hrs per week).

E Learning Resources

1. List Required Textbooks **5-** Optics 5th Edition, by Eugene Hecht, Pearson, 2016. **6-** Holographic Materials and Optical Systems, by Izabela Naydenova, InTech, 2017. **7-** Fundamentals of Photonics, Saleh & Teich, 2nd Ed., 2007, Wiley. **8-** Geometric Optics, by J. B. Tatum, 2006. **9-** Classical and Modern Optics, by Daniel A. Steck, University of Oregon, 2010.
2. List Essential References Materials (Journals, Reports, etc.)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
4. 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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) Lecture room with 25 seats, equipped with a Smart Board, projector, computers and internet connection.
2. Technology resources (AV, data show, Smart Board, software, etc.) **1.** Data Show. **2.** AV Presentations.

3. Matlab software
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) NA

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching **1.** Discussions on coverage, preferred activity, approach. **2.** Student course evaluation at the end of the course.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • Revision of student answer paper by another staff member. • Analysis of the grades of students. • Periodic self- assessment of the program. • Departmental council meetings.
3. Procedures for Teaching Development **1.** Sharing teaching experience during the department meetings. **2.** Constant update with the best teaching practices in case methodology. **3.** Attending workshop on effective teaching methods presented by experts on the teaching methodologies.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) • 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.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. The following points may help to get the course effectiveness ▪ Reviewing student's formal and informal feedback. ▪ Evaluating relevancy of the teaching methods on a regular basis. ▪ Discussing the results with the industry experts. ▪ Program Self study. According to the above points the plan of improvement should be given.

Name of Course Instructor: Mohamed Boustimi

Signature: _____ Date Completed: _____

Program Coordinator: Walid Belkacem Belhadj

Signature: _____ Date Received: _____

Course Title: **Optical Wave Propagation**

Course Code: **403627**-3

(O-2)

Date: 27/9/2018	**Institution:** Umm AL – Qura University
College: College of Applied Science	**Department:** Department of Physics

A. Course Identification and General Information

1. Course title and code: **Optical Wave Propagation (code: 403627)**			
2. Credit hours: **3Hrs**			
3. Program(s) in which the course is offered. **Master of Physics;** (If general elective available in many programs indicate this rather than list programs)			
4. Name of faculty member responsible for the course **Walid Belkacem Belhadj**			
5. Level/year at which this course is offered: **1st Year / Level 2**			
6. Pre-requisites for this course (if any):			
7. Co-requisites for this course (if any):			
8. Location if not on main campus: **Main campus and Alzaher**			
9. Mode of Instruction (mark all that apply):			
a. traditional classroom	✓	What percentage?	90
b. blended (traditional and online)		What percentage?	
c. e-learning	✓	What percentage?	10
d. correspondence		What percentage?	
f. other		What percentage?	
Comments:			

B Objectives

1. The main objective of this course

The purpose of this course is to provide students with fundamental concepts for the treatment of electromagnetic wave propagation in complex linear and nonlinear media and to give them an overview of guided wave optical devices and the principles underlying their operation.

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

1- Collaborate with other educational institutions to reveal how they deal with the subject.

2- Renew and update the course references periodically.

3- Frequently check the latest discovery in science to improve the course objectives.

4- Posting some course material on the websites to help the students.

5- Assigning presentations to students to improve their research skills.

6- Focusing on generic skills.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

This course gives a tool for the treatment of electromagnetic wave propagation in linear and nonlinear media as well as an overview of guided wave optical devices and the principles underlying their operation. It covers the foundation of electromagnetic optics, the propagation of electromagnetic plane waves within homogeneous, isotropic linear and nonlinear dielectric media, across planar boundaries between them, through periodic arrangements of dielectric layers, in planar waveguides and in optical fibers.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
❖ **Fundamentals of Electromagnetic wave theory:** Electromagnetic fields, electromagnetic properties of materials, Integral and differential time varying Maxwell's equations, Poynting's theorem, time harmonic Maxwell's equations, Boundary conditions, Plane wave propagation, Power flow density, Electromagnetic waves in a homogeneous medium; Refractive Index, Group velocity and group index.	**2**	**6**

❖ **Wave and interferences:** Phase Matching at planar interfaces, Propagating, surface, and evanescent waves, Transverse Electric (TE) and Transverse Magnetic (TM) modes, Snell's law, Fresnel Reflection, Reflection and transmission coefficients Brewster's Angle, Total Internal Reflection, Goos-Haenchen-Shift, Mirrors, Interferometers and Thin-Film Structures, photonic crystal; Dielectric layered media, Scattering and Transfer Matrix Formulation, Beamsplitter.	**3**	**9**
❖ **Electromagnetic Propagation in nonlinear Media:** Nonlinear optical media; nonlinear Harmonic Oscillator model, Nonlinear Susceptibility Tensors. Nonlinear Wave Propagation; Second Harmonic Generation, third Harmonic Generation, wave mixing, Phase Matching. Nonlinear optical processes; Kerr effect, Nonlinear Refractive index, Optical bistability, self focusing and phase modulation, Saturation of Absorption, Two-Photon Absorption, Stimulated Raman Scattering.	**3**	**9**
❖ **Optical Waveguides and Resonators:** Planar Dielectric Waveguides; Modes, Propagation Constants, Dispersion relations for TE and TM modes, Cut-off conditions and single mode operation, Field distribution and power flow, Mode orthogonality, Slab Waveguide, Numerical Aperture. Waveguide Coupling; Coupling of Modes and Coupled Mode Theory. Metallic Waveguides; Parallel plate metallic waveguides, Dispersion relations, single mode operation, Field distribution and power flow. Optical Resonators; Fabry-Perot Resonator; Finesse, spectral width and Quality Factor, loss, photon lifetime, photonic crystal cavity, Thin-Film Filters.	**4**	**9**
❖ **Optical fibers:** Evolution of Fiber Telecommunications, Ray analysis of optical fiber; Propagation mechanism of rays in an optical fiber, numerical aperture, dispersion. Step-index multimode fibers; Wave equation and boundary conditions, Characteristics equation, TE, TM and Hybrid modes, Weakly guiding approximation, linearly polarized (LP) modes, Single mode fiber, V – parameter, Power confinement and mode cutoff, Mode field diameter. Graded-index fiber; Modal analysis	**3**	**9**
	15 weeks	**45 hrs**

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	**30**	**15**	**0**	**0**	**0**	**45**
	Actual	**30**	**15**	**0**	**0**	**0**	**45**
Credit	Planned	**2**	**1**	**0**	**0**	**0**	**3**

	Actual	2	1	0	0	0	3

3. Individual study/learning hours expected for students per week.	**6**

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Describe electromagnetic wave propagation within homogeneous, isotropic linear dielectric media as well as across planar boundaries between them.	**1.** Lectures. **2.** Discussions **3.** Slides and computer simulation software may be used by the teachers to clarify concepts. **4.** Problems solving **5.** Students may be asked to solve some problems on computer using MATLAB language.	**1-** Home work assignments. **2-** Group Project assignment. **3-** Question – answer session in class. **4-** Exams: quizzes, Mid-term and final exams
1.2	Describe optics of nonlinear media in terms of susceptibility tensors and outline the associated nonlinear optical processes.		
1.3	Recognition of several guided wave optical devices and the principles underlying their operation.		
1.4	Reproduce how the wave equation is solved in waveguide geometries and how arbitrary solutions can be composed in terms of modes.		
1.5	Describe how transmission, reflection, absorption and dispersion in optical media can be characterized.		

1.6	Recognize some kinds of optical resonators and how they can be employed the confine light.		
2.0	**Cognitive Skills**		
2.1	Predict optical effects with e.g. light-matter interaction, interference, waveguides, optical fibers and geometrical optics using suitable mathematical principles.	**1.** Lectures. **2.** Discussions. **3.** Problems solving. **4.** Encourage the student to look for the information in different references. **5.** Ask the student to attend lectures for practice solving problem. 6. Following some proofs 7. Define duties for each chapter	**1-** Home work assignments. **2-** Group Project assignment. **3-** Question – answer session in class. **4-** Exams: quizzes, Mid-term and final exams.
2.2	Calculate parameters such as the cut-off frequency, number of modes, propagation constant, and group velocity, fraction of energy in core for metallic and dielectric waveguides and physically interpret them.		
2.3	Differentiate between linear and nonlinear optical media.		
2.4	Explain the principles of, compare and contrast single- and multi-mode planar and fiber optical waveguide characteristics.		
3.0	**Interpersonal Skills & Responsibility**		
3.1	Show responsibility for self-learning to be aware with recent developments in physics.	**1.** Ask the students to search the internet and use the library. **2.** Encourage them how to attend lectures regularly by assigning marks for attendance. **3.** Small group discussion. **4.** Give students tasks of duties. **5.** Discussion in class	**1.** Evaluate the scientific values of solutions. **2.** Evaluate the work in team **3.** Evaluation of the role of each student in group Project assignment **4.** Evaluation of student's presentations. **5.** Direct contact during office hours. **6.** Direct contact during office hours.
3.2	Show the ability to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.		
	Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.		
	Illustrate the interrelationships among numerical design, technology, and global society, and of the societal implications of new developments in science.		
4.0	**Communication, Information Technology, Numerical**		

4.1	Demonstrating capability in performing research as well as an effective oral and written communication.	**1.** Communicate effectively in writing, orally and through scientific diagrams. **2.** Preparing a report on some topics related to the course depending on web sites.	1. Evaluation of presentations 2. Evaluation of reports & Project assignment.
4.2	Acquire a working knowledge of basic research methodologies, data analysis and interpretation.	**1.** Independent study. **2.** Problem solving.	**1.** Homework **2.** Assignments.
4.3	Demonstrate effective written and oral communication skills, especially the ability to transmit complex technical information in a clear and concise manner.	**1.** Oral Presentations. **2.** Problem solving.	**1.** Homework. **2.** Assignments.
4.4	Use of the internet to research solution for relevant scientific problems.	**1.** Independent study.	**1.** Performance in problem solving. **2.** Assignments
4.5	Demonstrate enough knowledge in evaluating published works.	**1.** Independent study.	**1.** Performance in problem solving. **2.** Assignments.
5.0	**Psychomotor(if any)**		
5.1	N/A	N/A	N/A
5.2			

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Exercises & Home works	At the end of each chapter	10%
2	Participation in activities during lectures	All weeks	10%
3	Practical group projects	At the end of each chapter	10%

4	1st Periodic Exam	8th week	10%
5	2nd Periodic Exam	11th week	10%
6	Final Exam	16th week	50%
7			

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) Students are supervised by academic advisers in physics Department and the time tables for academic advices were given to the student each semester. (8hrs per week).

E Learning Resources

1. List Required Textbooks • Physics of Photonic Devices 2nd Edition by Shun Lien Chuang, Wiley, 2009. • Fundamentals of Photonics, Saleh&Teich, 2nd Ed., 2007, Wiley. • Nonlinear Optics, 3rd Edition, Robert Boyd, Academic Press, 2008 • Principles of Optics for Engineers: Diffraction and Modal Analysis 1st Edition, by William S. C. Chang, Cambridge University Press, 2015 • Fundamentals of Nonlinear Optics, by Peter E. Powers, CRC Press (2011).
2. List Essential References Materials (Journals, Reports, etc.)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
4. 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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) Lecture room with 25 seats, equipped with a Smart Board, projector, computers and internet connection.
2. Technology resources (AV, data show, Smart Board, software, etc.) **1.** Data Show. **2.** AV Presentations. **3.** Matlab software

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) NA

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching **1.** Discussions on coverage, preferred activity, approach. **2.** Student course evaluation at the end of the course.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • Revision of student answer paper by another staff member. • Analysis of the grades of students. • Periodic self- assessment of the program. • Departmental council meetings.
3. Procedures for Teaching Development **1.** Sharing teaching experience during the department meetings. **2.** Constant update with the best teaching practices in case methodology. **3.** Attending workshop on effective teaching methods presented by experts on the teaching methodologies.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) • 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.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. The following points may help to get the course effectiveness · Reviewing student's formal and informal feedback. · Evaluating relevancy of the teaching methods on a regular basis. · Discussing the results with the industry experts. · Program Self study. According to the above points the plan of improvement should be given.

Name of Course Instructor: _____ Walid Belkacem Belhadj __

Signature: _____ Date Completed: _____

Program Coordinator: ____ Walid Belkacem Belhadj _____

Signature: _____ Date Received: _____

Course Title: **Quantum Optics**

Course Code: **403625-3**

(O-3)

Date: 5- 10- 2018.	**Institution:** Umm Al-Qura University
College: College of Applied Sciences	**Department:** Physics

A. Course Identification and General Information

1. Course title and code: Quantum Optics (403625)		
2. Credit hours: 3		
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) Masters		
4. Name of faculty member responsible for the course: Dr. Tasnim Azim		
5. Level/year at which this course is offered: First year / level 2		
6. Pre-requisites for this course (if any):		
7. Co-requisites for this course (if any):		
8. Location if not on main campus: Main and Al-Zaher campus		
9. Mode of Instruction (mark all that apply):		
a. Traditional classroom	✓ percentage?	**90%**
b. Blended (traditional and online) percent		
c. E-learning	percentage?	
d. Correspondence	percentage?	
f. Other	✓ percentage?	**10%**

Comments:

B Objectives

1. The main objective of this course is to give the photon concept of quantum electromagnetic field and to develop tools to handle different physical situations of atom-field interaction in semi-classical and quantum mechanical theory. These tools will then be applied to different situations of atom-field interaction. The course will also touch the recent topics of research in this field.

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

The current topics of research should be included in the course using on-line journals and sites like Web of Knowledge, that give updates about the topics of increasing interest.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Quantum Optics describes light and its interaction with matter quantum mechanically. It teaches the mathematical tools for handling atom-photon interaction. The course will showhow classical formulation of interaction can be derived in the quantum optical context. The non-classical properties of light will also be discussed, which have no counter-part in classical physics. As an application of the tools described, some very novel applications of quantum optics which can be experimentally tested and those which have already been experimentally verified will be discussed in the course.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Introduction to Quantum Optics and lasers: Comparison of classical and quantum field, properties and representation of vacuum, coherent states, squeezed states of quantum light. Review of quantum mechanical tools for describing interaction of atom with field.	2	6
Semi-classical theory of atom-field interaction: Interaction of a single mode field with two-level atom, Probability amplitude method, Interaction picture	2	6
Density matrix for two-level atom: Equation of motion for the density matrix, Two-level atom.	1	3

Maxwell-Schrodinger equations: Population matrix and its equation of motion, Maxwell's equation for slowly varying field functions	1	3
Atom-field interaction- quantum theory: Atom-field interaction Hamiltonian, Interaction of a single two-level atom with a single-mode field, Probability amplitude method, Heisenberg operator method, Unitary time-evolution operator method, Weisskopf-Wigner theory of spontaneous emission between two atomic levels	5	15
Applications: Coherent dark trapping, Electromagnetically induced transparency, Lasing without inversion, Refractive index enhancement via quantum coherence	4	12
	45 hours	15 weeks

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	45				10	55
	Actual						
Credit	Planned	3					3
	Actual						

3. Individual study/learning hours expected for students per week. 6

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Description of characteristics, properties and states of quantum field,	Begin with the significance and the general idea of the topic.	Questioning during the lecture
1.2	Analysis of the physics and calculation of the interaction dynamics of atom interacting with classical field.	Explain the topic with figures and diagrams on the board	Homework, quizzes and mid-term exam.
1.3	Describe the approaches of atom-field interaction with probability amplitude method, interaction picture and density matrix approach and their respective significance in quantum theory.	Ask question during the lecture to keep the students involved.	
1.4	Describe the phenomenon of spontaneous emission.		
1.5	Application of the described tools on some quantum optical phenomena.		
2.0	**Cognitive Skills**		
2.1	Be familiar with the current research topics in the field of Quantum Optics and Quantum Information	Ask students to do some related small researches	Discussion during lecture
2.2	Use mathematical tools to describe the physical models.	Ask questions during lecture	Homework, quizzes, exams.
3.0	**Interpersonal Skills & Responsibility**		
3.1	Able to apply fundamental principles to different research fields of Quantum Optics	Group project work	Evaluation the efforts of each individual member of the group in the project report
3.2	Working and discussion in groups with shared constructive responsibilities.	Present the project group-wise	Evaluation of group project as a whole
4.0	**Communication, Information Technology, Numerical**		

4.1	Carry out academic work independently using the bibliography and internet search engines.	Homework involving plotting	Assessment of homework and project
4.2	Develop critical thinking and reasoning.	Small research project	
5.0	**Psychomotor(if any)**		
5.1			
5.2			

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Homework exercises	Every week	15%
2	Short quizzes	5th, 9th week	10%
3	Lecture participation	Every week	5%
4	Mid-term exam	7th, 11th week	30%
5	Final exam	16th week	40%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) 4 hours

E Learning Resources

1. List Required Textbooks i-Quantum Optics, M. O. Scully and M. S. Zubairy, *Cambridge University Press*, (1997). ii- Introduction to Quantum Optics, G. Grynberg, A. Aspect and C. Fabre, *Cambridge University Press*, (2010). iii. The Quantum Theory of Light (Oxford Science Publications) 3rd Edition, Rodney Loudon (2000) ISBN-13: 978-0198501763 iV. Quantum Optics for Beginners, Zbigniew Ficek , Mohamed Ridza Wahiddin (2016) ISBN-13: 978-9814411752
2. List Essential References Materials (Journals, Reports, etc.)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. Software: 'Mathematica'

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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) Classrooms with white board
2. Technology resources (AV, data show, Smart Board, software, etc.)
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching Encouraging students to participate in the thinking process during the lecture. Course reports. Course evaluation.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department Students grades Students feedback
3. Procedures for Teaching Development Providing lecture notes, Putting up homework solutions for the students.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) Course project reports Homework Quizzes
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. Keeping in touch with the current research and including the related topics of interest in the syllabus.

Name of Course Instructor: _____ Tasnim Azim _____

Signature: _____ Date Completed: _____

Program Coordinator: ___ Walid Belkacem Belhadj _____

Signature: _____ Date Received: _____

Course Title: **Numerical methods in photonics**

Course Code: **403623**

(O-4)

Date: 27/9/2018	**Institution:** Umm AL – Qura University
College: College of Applied Science	**Department:** Department of Physics

A. Course Identification and General Information

1. Course title and code: **Numerical methods in photonics (code: 403623)**
2. Credit hours: **3Hrs**
3. Program(s) in which the course is offered. **Master of Physics;**

   (If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course

   Walid Belkacem Belhadj
5. Level/year at which this course is offered: **1st Year / Level 2**
6. Pre-requisites for this course (if any): **403656**
7. Co-requisites for this course (if any):
8. Location if not on main campus: **Main campus and Alzaher**
9. Mode of Instruction (mark all that apply):

a. traditional classroom	✓	What percentage?	90
b. blended (traditional and online)		What percentage?	
c. e-learning	✓	What percentage?	10
d. correspondence		What percentage?	
f. other		What percentage?	

Comments:

B Objectives

1. The main objective of this course

This course introduces most widely used computational photonic methods employed to describe propagation of light through homogeneous and inhomogeneous media, and its interaction (linear and nonlinear) with matter. The main goal is to provide the students with some numerical techniques that will allow them to model optical and photonic systems. Upon completion of this course, students will be familiar with modeling of modern photonics components using numerical techniques including: Modal Methods (Transfer Matrix Method (TMM) and Rigorous coupled-wave analysis (RCWA)), finite difference frequency-domain (FDFD), finite difference time-domain (FDTD) methods and finite element method (FEM). Students will also learn to model the propagation of pulses and beams in nonlinear optical materials by using 1+1D nonlinear propagation Formalism. Also, students will be able to identify the appropriate computational method for a photonics modeling problem.

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

1- Collaborate with other educational institutions to reveal how they deal with the subject.

2- Renew and update the course references periodically.

3- Frequently check the latest discovery in science to improve the course objectives.

4- Posting some course material on the websites to help the students.

5- Assigning presentations to students to improve their research skills.

6- Focusing on generic skills.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

This course addresses graduate students who are interested in numerical methods for studying both fundamental optics and applications such as design, development, and optimization of photonic devices. The numerical techniques considered here are finite-difference method in both, time and frequency domain (FDTD & FDFD), 1+1D nonlinear propagation, Transfer Matrix Method (TMM), Rigorous coupled-wave analysis (RCWA) and finite element method (FEM). After an introductory chapter outlining the essentials of Maxwell's equations, each method is accompanied by a review of the mathematical principles in which it is based, along with sample scripts, illustrative examples of characteristic problem solving, and exercises. Note that the implementation language is MATLAB.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
❖ **Review of Basic Principles of Electromagnetic Theory:** Integral form of Maxwell's equations, Constitutive Relations, Electromagnetic Properties of a Medium, Time–domain differential Maxwell's Equations, the Wave equation, and Time harmonic Maxwell's equation, Helmholtz Equations, Waveguides and Eigenmodes.	1	3
❖ **Finite-Difference modeling (FDM):** Finite-Difference Method (FDM): Review of Linear Algebra, Finite-Differences, Finite-Difference Method (FDM), Matrix Operators, finite-Difference Analysis of optical Waveguides; Formulation of rigorous full-vectorial Modesolver; Formulation of semi-vectorial analysis, Slab waveguide analysis, Implementation. Finite-Difference Frequency-Domain (FDFD): Formulation of 2D-FDFD boundary conditions, Plane wave source, Calculating transmittance and reflectance. Beam Propagation Method: Formulation of 2D finite-difference beam propagation, method (FD-BPM), Transparent boundary condition, stability condition, Implementation.	3	9
❖ **Finite-Difference Time-Domain Method (FDTD):** Discretization of the electromagnetic fields: Yee grid Scheme, Finite-Difference Approximation of Maxwell's Equations. 1D-FDTD Analysis: Basic Update Equations, Spatial Step and Numerical Dispersion, Time Step and Stability of the Solution, FDTD Sources, Absorbing Boundary Conditions, Simulation of Lossy, Dispersive Materials, Implementation of 1D-FDTD Algorithm. FDTD Method in 2D and 3D: Yee Cell, Update Equations in 2D and 3D, Dispersion Analysis, Perfectly Matched Layer Absorbing boundary condition (PML-ABC), Stability conditions, resolution, numerical artifacts.	3	9
❖ **Modeling of Nonlinear Propagation in Waveguides:** Nonlinear Formalism: General Propagation Equation, Pulse Power and Pulse Energy, Nonlinear Polarization, Nonlinear Processes, Single-Mode Propagation Model.Nonlinear Schrödinger (NLS) Equation: Derivation of the NLS Equation, Dispersion and Self-Phase Modulation, Optical Solitons, Solitons and Raman Effects, Self-Steepening, Conservation Laws. Numerical Implementation: Fourier Method, Stepping Techniques, Discrete Fourier Grids.	2	6

❖ **Modal Methods :** 1D Geometry: Eigenmode formulation. Transfer Matrix Method (TMM); Maxwell's equations for 1D structures, Solution to Maxwell's equations in a homogeneous layer, 1D Interface, Multilayer structures, Stability of TMM, TMM Using Scattering Matrices; Calculating Transmitted and Reflected Power, 1D-Periodic Structures, 1D Cavity. 2D Geometry: Plane Wave Expansion Method (PWEM); basic 3D eigen-value problem, Formulation of efficient 1D, 2D and 3D-PWEM, Calculation of band diagrams. Rigorous Coupled-Wave Analysis (RCWA): Background of the RCWA method, Matrix wave equation, Solution to the matrix wave equation, S-matrix approach in layered periodic structures, Calculate transmission and reflection, Formulation of 2D-RCWA with fast Fourier factorization.	**3**	**9**
❖ **Finite Element Method (FEM):** Basic concepts of Finite Element Analysis: Meshing of the Geometry, Derivation of the Element Matrix, Assembly of Element Matrices, Solution of System Matrix, Postprocessing. Helmholtz Equation in 1D, Variational Formulation, Galerkin Method, Discrete Problem, Linear Finite Elements, Domain Mapping, Assembly Process, Algorithm: Plane-Wave Propagation. General Scattering Problem in 1D: Variational Formulation in 1D with Dirichlet-to-Neumann (DtN) Operator, Variational Formulation in 1D with Perfectly Matched Layers (PMLs), Discretization, Error Estimation, Mesh Refinement. Maxwell and Helmholtz Scattering Problems: Variational Forms, Transformation Rules, PML in 2D and 3D, Variational Formulation with PML. FEM for Helmholtz Scattering in 2D and 3D: Rectangular Meshes, General Assembly Process, Finite Elements for Rectangular Meshes, Finite Elements for Triangular Meshes. FEM for Maxwell's Scattering in 2D and 3D: Finite Elements for Rectangular Meshes, Finite Elements for Triangular Meshes.	**3**	**9**
	15 weeks	**45 hrs**

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	**30**	**15**	**0**	**0**	**0**	**45**
	Actual	**30**	**15**	**0**	**0**	**0**	**45**
Credit	Planned	**2**	**1**	**0**	**0**	**0**	**3**
	Actual	**2**	**1**	**0**	**0**	**0**	**3**

3. Individual study/learning hours expected for students per week. **6**

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Recognize basic concepts of the most popular methods used in modern computational electromagnetism including: finite-difference method in both the time and frequency domain (FDTD & FDFD), Modal Methods (TMM and RCWA) and Finite Element Method (FEM).	**1.** Lectures. **2.** Discussions **3.** Slides and computer simulation software may be used by the teachers to clarify concepts. **4.** Problems solving **5.** Students may be asked to solve problems and to write simple programs in MATLAB language.	**1-** Home work assignments. **2-** Group Project assignment. **3-** Question – answer session in class. **4-** Exams: quizzes, Mid-term and final exams
1.2	Reproduce and implement numerical methods such as FDM, FDFD, FDTD, TMM, RCWA and FEM to simulate some modern photonic components.		
1.3	Describe the conditions and approximations under which full- and semi vectorial wave equations in the frequency domain for guided modes in planar waveguides may be derived		
1.4	Outline how nonlinear propagation in the guided modes of optical waveguides can be described efficiently in a so-called 1+1D propagation formalism based on nonlinear Schrödinger equation.		
1.5	Describe the advantages and disadvantages as well as the limitations of each studied numerical method.		
2.0	**Cognitive Skills**		

2.1	Getting a basic insight into numerical techniques for photonics.	**1.** Lectures. **2.** Discussions. **3.** Problems solving. **4.** Encourage the student to look for the information in different references. **5.** Ask the student to attend lectures for practice solving problem.	**1-** Home work assignments. **2-** Group Project assignment. **3-** Question – answer session in class. **4-** Exams: quizzes, Mid-term and final exams
2.2	Criticize the possibility of use of a certain numerical method to simulate a given photonic problem.		
2.3	Differentiate between time domain and frequency domain computational techniques.		
2.4	Implement and develop a numerical tool in MATLAB to Design, analyse and predict the behaviours of some photonic devices.		
2.5	Analyze the propagation of short and long pulses in some photonic devices and calculate reflection and transmission spectra, group velocity, field amplitudes in these devices.		
2.6	Getting a basic insight in the effects of symmetry on photonic systems.		
3.0	**Interpersonal Skills & Responsibility**		
3.1	Show responsibility for self-learning to be aware with recent developments in physics	**1.** Ask the students to search the internet and use the library. **2.** Encourage them how to attend lectures regularly by assigning marks for attendance. **3.** Small group discussion. **4.** Give students tasks of duties	**1.** Evaluate the scientific values of solutions. **2.** Evaluate the work in team **3.** Evaluation of the role of each student in group Project assignment **4.** Evaluation of student's presentations. **5.** Direct contact during office hours.
3.2	Ability to choose the best numerical method to simulate a given photonic device and so can analyse a photonic problem by using suitable numerical method.		
3.3	Work effectively both individually and in teams.		
3.4	Communicate effectively with peers.		
3.4	Illustrate the interrelationships among numerical design, technology, and global society, and	**1.** Discussion in class	**1.** Direct contact during office hours.

	of the societal implications of new developments in science.		
4.0	**Communication, Information Technology, Numerical**		
4.1	Demonstrating capability in performing research as well as an effective oral and written communication.	**1.** Communicate effectively in writing, orally and through scientific diagrams. **2.** Preparing a report on some topics related to the course depending on web sites.	1. Evaluation of presentations 2. Evaluation of reports & Project assignment.
4.2	Acquire a working knowledge of basic research methodologies, data analysis and interpretation.	**1.** Independent study. **2.** Problem solving.	**1.** Homework **2.** Assignments.
4.3	Demonstrate effective written and oral communication skills, especially the ability to transmit complex technical information in a clear and concise manner.	**1.** Oral Presentations. **2.** Problem solving.	**1.** Homework. **2.** Assignments.
4.4	Use of the internet to research solution for relevant scientific problems.	**1.** Independent study.	**1.** Performance in problem solving. **2.** Assignments
4.5	Demonstrate enough knowledge in evaluating published works.	**1.** Independent study.	**1.** Performance in problem solving. **2.** Assignments.
5.0	**Psychomotor(if any)**		
5.1	N/A	N/A	N/A
5.2			

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Exercises & Home works	At the end of each chapter	10%
2	Participation in activities during lectures	All weeks	10%

3	Practical group projects	At the end of each chapter	10%
4	1st Periodic Exam	8th week	10%
5	2nd Periodic Exam	11th week	10%
6	Final Exam	16th week	50%
7			

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) Students are supervised by academic advisers in physics Department and the time tables for academic advices were given to the student each semester. (8hrs per week).

E Learning Resources

1. List Required Textbooks • Numerical Methods in Photonics, by A. V. Lavrinenko, et al, CRC Press, 2017. • Analytical and Computational Methods in Electromagnetics, by Ramesh Garg, ARTECH HOUSE 2008. • Computational Electromagnetics (Second Edition), by A. Bondeson et al, Sringer, 2010. • Computational methods for electromagnetic and optical systems, (Second Edition), by J. M. Jarem & P. P. Banerjee, CRC Press, 2011.
2. List Essential References Materials (Journals, Reports, etc.)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
4. 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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) Lecture room with 25 seats, equipped with a Smart Board, projector, computers and internet connection.
2. Technology resources (AV, data show, Smart Board, software, etc.)

1. Data Show. **2.** AV Presentations. **3.** Matlab software
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) NA

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching **1.** Discussions on coverage, preferred activity, approach. **2.** Student course evaluation at the end of the course.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • Revision of student answer paper by another staff member. • Analysis of the grades of students. • Periodic self- assessment of the program. • Departmental council meetings.
3. Procedures for Teaching Development **1.** Sharing teaching experience during the department meetings. **2.** Constant update with the best teaching practices in case methodology. **3.** Attending workshop on effective teaching methods presented by experts on the teaching methodologies.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) • 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.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. The following points may help to get the course effectiveness · Reviewing student's formal and informal feedback. · Evaluating relevancy of the teaching methods on a regular basis. · Discussing the results with the industry experts. · Program Self study. According to the above points the plan of improvement should be given.

Name of Course Instructor: _ Walid Belkacem Belhadj _____

Signature: _____ Date Completed: _____

Program Coordinator: _____ Walid Belkacem Belhadj _____

Signature: _____ Date Received: _____

Course Title: **Laser physics and Optoelectronics**

Course Code: **403618**-3

(O-5)

Date: 27/9/2018	**Institution:** Umm AL – Qura University
College: College of Applied Science	**Department:** Department of Physics

A. Course Identification and General Information

1. Course title and code: **Laser physics and Optoelectronics (code: 403618)**		
2. Credit hours: **3Hrs**		
3. Program(s) in which the course is offered. **Master of Physics;** (If general elective available in many programs indicate this rather than list programs)		
4. Name of faculty member responsible for the course **Mohamed M. Sabry**		
5. Level/year at which this course is offered: **2st Year / Level 3**		
6. Pre-requisites for this course (if any): **403625**		
7. Co-requisites for this course (if any):		
8. Location if not on main campus: **Main campus and Alzaher**		
9. Mode of Instruction (mark all that apply):		
a. traditional classroom	✓	What percentage? **90**
b. blended (traditional and online)		What percentage?
c. e-learning	✓	What percentage? **10**
d. correspondence		What percentage?
f. other		What percentage?
Comments:		

B Objectives

1. The main objective of this course

The overall aim of this course is to provide the students a broad overview of the various laser systems currently being used in both scientific and industrial fields. This court also gives fundamental knowledge of wide variety of different semiconductor and organic optoelectronic devices in order to be able to understand present and future technologies for applications in lightwave systems, as well as energy conversion that has found renewed interest recently due to world-wide demands of energy saving and renewable energy production.

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

1- Collaborate with other educational institutions to reveal how they deal with the subject.

2- Renew and update the course references periodically.

3- Frequently check the latest discovery in science to improve the course objectives.

4- Posting some course material on the websites to help the students.

5- Assigning presentations to students to improve their research skills.

6- Focusing on generic skills.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

This course is designed to introduce the students to the fields of Laser and Semiconductor Optoelectronics, which deals with the physics and technology of semiconductor optoelectronic devices such as light emitting diodes, laser diodes and photodiodes, which are becoming important components in consumer optoelectronics and communication devices, and in industrial instrumentation. The course begins with a review of essential of semiconductor physics, followed by the study of interaction of photons with electrons and holes in a semiconductor, leading to the realization of semiconductor photon amplifiers, sources, modulators, and detectors.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
❖ **Quantum-mechanical description of Light-Matter Interaction:** Photon streams, Quantum states of light, Atoms, Molecules, and solids, Energy levels, Interaction of Photons with atoms, Thermal light, Luminescence and scattering.	2	6

❖ **Semiconductor Science and Light Emitting Diodes:** Semiconductor concepts and energy bands, Direct and indirect bandgap semiconductors, p-n junction principles, the p-n junction band diagram, Light-emission processes in semiconductors, Light-emitting diodes (LEDs).	3	9
❖ **Optical Amplifiers and Lasers:** Stimulated Emission Devices Lasers; Stimulated emission and light amplification, Einstein coefficients, Optical fiber amplifiers, Gas laser and He-Ne Laser, The output spectrum of a gas laser. Laser oscillation conditions, Semiconductor lasers (laser diodes), Rate equation, and Light emitters for optical fiber communications.	3	9
❖ **Semiconductor Photodetectors:** Types of photodetectors, Photoconductors, Single junction under illumination: photon and carrier-loss mechanisms, Noise in photodetection; Photodiodes, Photo-transistors, solar cells.	3	9
❖ **Introduction Organic Optoelectronics:** Organic/polymer photonic materials, electronic properties, sigma and pi bonds, Band theory, conduction in organic semiconductors and polymers, HOMO-LUMO energy levels, Charge generation by photo-excitation and recombination, Diffusion and drift of charge carriers. Advanced materials for photonic applications: Fullerenes, Carbon nanotubes, graphenes and other 2D van der Waals materials. Applications of organic photonic materials: Photovoltaic cells, Light emitting diodes, Photorefractive polymers.	4	12
	15 weeks	**45 hrs**

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	30	15	0	0	0	45
	Actual	30	15	0	0	0	45
Credit	Planned	2	1	0	0	0	3
	Actual	2	1	0	0	0	3

3. Individual study/learning hours expected for students per week. 6

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Recall Classical and Quantum mechanical descriptions of light matter interaction.	**1.** Lectures. **2.** Discussions **3.** Slides and computer simulation software may be used by the teachers to clarify concepts. **4.** Problems solving **5.** Students may be asked to solve some problems on computer using MATLAB language.	**1-** Home work assignments. **2-** Group Project assignment. **3-** Question – answer session in class. **4-** Exams: quizzes, Mid-term and final exams
1.2	Define the principles of functioning of most important optoelectronic devices.		
1.3	Describe most common laser operating principles and structures as well as basic physical principles related to laser pumping and semiconductors.		
1.4	Recognize various physical processes of optoelectronic transitions, and outline basic relations between material optical properties and devices in optoelectronics.		
1.5	Recognize optical and electronic properties in organic molecules and polymers that are highly critical for photonic and optoelectronic applications.		
1.6	Recognize semiconductor photon amplifiers, sources, modulators, and detectors.		
2.0	**Cognitive Skills**		
2.1	Explain and implement the equations, which determine main characteristics of optoelectronic devices.	**1.** Lectures. **2.** Discussions.	**1-** Home work assignments.

2.2	Differentiate between laser and thermal radiation	**3.** Problems solving. **4.** Encourage the student to look for the information in different references. **5.** Ask the student to attend lectures for practice solving problem. 6. Following some proofs 7. Define duties for each chapter	**2-** Group Project assignment. **3-** Question – answer session in class. **4-** Exams: quizzes, Mid-term and final exams.
2.3	Apply the knowledge of different optoelectronic components to solve problems mainly in the physics and technical areas.		
2.4	Analyze operational modes of photonic devices, in order to select suitable type for given applications.		
2.5	Explain the interconnections between device design, mode of operation and characteristics, and the overall efficiency of optoelectronic devices and signal transmission.		
2.6	Explain the principles of operation of quantum lasers, calculate characteristics of optical resonators.		
2.7	Calculate parameters and design simple systems for optical communication or energy conversion.		
3.0	**Interpersonal Skills & Responsibility**		
3.1	Show responsibility for self-learning to be aware with recent developments in physics.	**1.** Ask the students to search the internet and use the library. **2.** Encourage them how to attend lectures regularly by assigning marks for attendance. **3.** Small group discussion. **4.** Give students tasks of duties. **5.** Discussion in class	**1.** Evaluate the scientific values of solutions. **2.** Evaluate the work in team **3.** Evaluation of the role of each student in group Project assignment **4.** Evaluation of student's presentations. **5.** Direct contact during office hours. **6.** Direct contact during office hours.
3.2	Show the ability to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.		
	Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.		
	Illustrate the interrelationships among numerical design, technology, and global society, and of the societal implications of new developments in science.		
4.0	**Communication, Information Technology, Numerical**		

4.1	Demonstrating capability in performing research as well as an effective oral and written communication.	**1.** Communicate effectively in writing, orally and through scientific diagrams. **2.** Preparing a report on some topics related to the course depending on web sites.	1. Evaluation of presentations 2. Evaluation of reports & Project assignment.
4.2	Acquire a working knowledge of basic research methodologies, data analysis and interpretation.	**1.** Independent study. **2.** Problem solving.	**1.** Homework **2.** Assignments.
4.3	Demonstrate effective written and oral communication skills, especially the ability to transmit complex technical information in a clear and concise manner.	**1.** Oral Presentations. **2.** Problem solving.	**1.** Homework. **2.** Assignments.
4.4	Use of the internet to research solution for relevant scientific problems.	**1.** Independent study.	**1.** Performance in problem solving. **2.** Assignments
4.5	Demonstrate enough knowledge in evaluating published works.	**1.** Independent study.	**1.** Performance in problem solving. **2.** Assignments.
5.0	**Psychomotor(if any)**		
5.1	N/A	N/A	N/A
5.2			

5. Assessment Task Schedule for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Exercises & Home works	At the end of each chapter	10%
2	Participation in activities during lectures	All weeks	10%
3	Practical group projects	At the end of each chapter	10%

4	1st Periodic Exam	8th week	10%
5	2nd Periodic Exam	11th week	10%
6	Final Exam	16th week	50%
7			

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) Students are supervised by academic advisers in physics Department and the time tables for academic advices were given to the student each semester. (8hrs per week).

E Learning Resources

1. List Required Textbooks **10-** Fundamentals of Photonics, Saleh&Teich, 2nd Ed., 2007, Wiley. **11-** Photonics: Optical Electronics in Modern Communications 6th Edition, by A. Yariv and P. Yeh, Oxford University Press, New York, 2007. **12-** Fundamentals of Guided-Wave Optoelectronic Devices 1st Edition, Kindle Edition, by William S. C. Chang, Cambridge University Press, 2009. **13-** Integrated Optics: Theory and Technology, by Hunsperger Robert, Springer-Verlag Berlin Heidelberg, 2002.
2. List Essential References Materials (Journals, Reports, etc.)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
4. 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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) Lecture room with 25 seats, equipped with a Smart Board, projector, computers and internet connection.
2. Technology resources (AV, data show, Smart Board, software, etc.)

1. Data Show. **2.** AV Presentations. **3.** Matlab software
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) NA

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching **1.** Discussions on coverage, preferred activity, approach. **2.** Student course evaluation at the end of the course.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department • Revision of student answer paper by another staff member. • Analysis of the grades of students. • Periodic self- assessment of the program. • Departmental council meetings.
3. Procedures for Teaching Development **1.** Sharing teaching experience during the department meetings. **2.** Constant update with the best teaching practices in case methodology. **3.** Attending workshop on effective teaching methods presented by experts on the teaching methodologies.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution) • 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.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it. The following points may help to get the course effectiveness ▪ Reviewing student's formal and informal feedback. ▪ Evaluating relevancy of the teaching methods on a regular basis. ▪ Discussing the results with the industry experts. ▪ Program Self study. According to the above points the plan of improvement should be given.

Name of Course Instructor: _ Mohamed M. Sabry _____

Signature: _____ Date Completed: _____

Program Coordinator: _____ Walid Belkacem Belhadj _____

Signature: _____ Date Received: _____

Course Title: **Biophotonics**

Course Code: **403622-3**

(O-6)

Date: 27/9/2018	**Institution:** Umm AL – Qura University
College: College of Applied Science	**Department:** Department of Physics

A. Course Identification and General Information

1. Course title and code: **Biophotonics (code: 403622)**			
2. Credit hours: **3Hrs**			
3. Program(s) in which the course is offered. **Master of Physics;** (If general elective available in many programs indicate this rather than list programs)			
4. Name of faculty member responsible for the course **Walid Belkacem Belhadj**			
5. Level/year at which this course is offered: **2nd Year / Level 3**			
6. Pre-requisites for this course (if any): **: 403621**			
7. Co-requisites for this course (if any):			
8. Location if not on main campus: **Main campus and Alzaher**			
9. Mode of Instruction (mark all that apply):			
a. traditional classroom	✓	What percentage?	90
b. blended (traditional and online)		What percentage?	
c. e-learning	✓	What percentage?	10
d. correspondence		What percentage?	
f. other		What percentage?	
Comments:			

B Objectives

1. The main objective of this course

The main objective of this course is to learn about the emerging field of biophotonics which deals with the application of optics based technologies for life science applications such as biosensing, imaging, cell manipulation and so on. It gives the student knowledge of the fundamentals of interaction between light and highly scattering media, such as molecules, cells and tissues. This knowledge is major for a large number of clinical diagnostic techniques as well as laser based treatment modalities. Biomedical optics is a fast developing field of research and the medical industry will require people with this knowledge.

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

1- Collaborate with other educational institutions to reveal how they deal with the subject.

2- Renew and update the course references periodically.

3- Frequently check the latest discovery in science to improve the course objectives.

4- Posting some course material on the websites to help the students.

5- Assigning presentations to students to improve their research skills.

6- Focusing on generic skills.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

This course covers the fundamental optical principles, techniques and instruments used in biomedical research and clinical medicine. It introduces the basics of biology and photonics, and provides the most relevant and important application examples selected from chemistry, biology, pharmacology and medicine. The course includes in-depth following biophotonics aspects: light - biological matter interactions, optical spectroscopies and their applications, lasers in biology and medicine, photobiology, optical imagery, optical biosensors, light as a therapeutic tool, micro-array technology, laser tweezers and emerging biophotonic technologies.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours

❖ **Fundamental Concepts of Biology:** Overview of Biophotonics: Biology and Biophotonics, Medicine/Clinics and Biophotonics. Basics of Biology: Cellular Structure, Various Types of Cells, Chemical Building Blocks, Biopolymers, Cellular Components, Cellular Processes, Protein Classification and Function, Organization of Cells into Tissues, Types of Tissues and Their Functions, Tumors and Cancers.	**2**	**3**
❖ **Light - biological matter interactions:** Nature of Light: Dual Character of Light, Optical Activity and Birefringence, Light Sources. Quantized States of Matter: Quantized States of Atoms and Molecules, Partitioning of Molecular Energies, Electronic and Vibrational States of a Molecule, Bonding in Organic Molecules, Conjugated Organic Molecules, Intermolecular Effects. Light-matter interactions in molecules, cells and tissues, Interaction of Light with a Bulk Matter, Various Types of Spectroscopy, Optical properties of bio-materials, Principles of Lasers, Lasers for Biophotonics, Current Laser Technologies, Intense Laser Beam, Radiometry.	**3**	**9**
❖ **Photobiology and Bioimaging:** Photobiology: Interaction of Light with Cells, Absorption in Cell, Light-Induced Cellular Processes, Photochemistry, Interaction of Light with Tissues, Photonic processes in Biopolymers, Human Eye and Vision, Photosynthesis, Photoexcitation, Optical Biopsy. Bioimaging Techniques: Transmission Microscopy, Fluorescence Microscopy, Scanning Microscopy, Inverted and Upright Microscopes, Confocal Microscopy, Multiphoton Microscopy, Optical Coherence Tomography, Total Internal Reflection Fluorescence Microscopy, Near-Field Optical Microscopy, Spectral and Time-Resolved Imaging, Fluorescence Resonance Energy Transfer, Imaging, Fluorescence Lifetime Imaging Microscopy, Nonlinear Optical Imaging. Applications: Imaging of Microbes, Cellular Imaging, Tissue Imaging.	**4**	**9**
❖ **Optical Biosensors** Physical Principles of Optical Biosensing, Biorecognition, Optical Transduction, Fluorescence Sensing, Fluorescence Energy Transfer Sensors, Molecular Beacons, Optical Geometries of Biosensing, Immobilization of Biorecognition, Fiber-Optic Biosensors, Planar Waveguide Biosensors, Evanescent Wave Biosensors, Interferometric Biosensors, Surface Plasmon Resonance Biosensors, Other Sensing Methods.	**2**	**6**
❖ **Laser Tweezers and emerging biophotonic technologies:** Principle of Laser Tweezer Action, Design of a Laser Tweezer, Optical Trapping Using Non-Gaussian Beams, Dynamic Holographic Optical Tweezers, Laser Scissors, Laser Pressure Catapulting, Laser Capture Microdissection, Manipulation of Single DNA Molecules, Molecular Motors, Protein–Protein Interactions, Laser Microbeams for Genomics and Proteomics, Laser Manipulation in Plant Biology, Laser Micromanipulation for Reproduction Medicine. Nanotechnology for Biophotonics: Nanochemistry, Semiconductor Quantum Dots for Bioimaging, Metallic Nanoparticles and Nanorods for Biosensing.	**4**	**12**
	15 weeks	**45 hrs**

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	30	15	0	0	0	45
	Actual	30	15	0	0	0	45
Credit	Planned	2	1	0	0	0	3
	Actual	2	1	0	0	0	3

3. Individual study/learning hours expected for students per week. 6

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

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 targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Describe light-biological matter interaction; such as absorption, emission, spectral response, reflection fluorescence, scattering, etc.	**1.** Lectures. **2.** Discussions **3.** Slides and computer simulation software may be used by the teachers to clarify concepts.	**1-** Home work assignments. **2-** Group Project assignment. **3-** Question – answer session in class.
1.2	Outline digital imaging concepts relevant to biomedical applications.		
1.3	Recognition of most optical techniques applied to biological materials.		

1.4	Describe the principle of laser action and understand the mode of operation of the various components in different laser systems.	**4.** Problems solving **5.** Students may be asked to solve some problems on computer using MATLAB language.	**4-** Exams: quizzes, Mid-term and final exams
1.5	Recognize histological tissue sections and describe how their characteristics will alter light propagation.		
1.6	Outline optical biosensor methods and principles in optogenetcis Fluorescent labeling and the mechanism of fluorescent resonant energy transfer.		
1.7	Describe the steps in the histological processing of tissues for microscopic visualization.		
2.0	**Cognitive Skills**		
2.1	Predict different light-tissue interactions, e.g.: Photochemical, thermal, photo induced plasma and photo ablation, and be able to relate these interactions to the characteristics of the light source.	**1.** Lectures. **2.** Discussions. **3.** Problems solving. **4.** Encourage the student to look for the information in different references. **5.** Ask the student to attend lectures for practice solving problem. 6. Following some proofs 7. Define duties for each chapter	**1-** Home work assignments. **2-** Group Project assignment. **3-** Question – answer session in class. **4-** Exams: quizzes, Mid-term and final exams
2.2	Assess / Evaluate advantages and disadvantages of particular bio photonics technique to solve the problems at the interface of engineering and biology.		
2.3	Formulate the role of photonics in biology and biomedicine and derive the main concepts involved in the interaction of optical radiation with biological materials.		
2.4	Identify biomedical applications, specify the performance requirements, and find adequate optics solutions.		
2.5	Criticize the main applications of biophotonics in particular in the area of imaging and diagnostics.		
2.6	Solve numerical problems which illustrate the principles of phenomena such as luminescence, absorption and scattering.		
2.7	Explain the basic principles for therapeutic and diagnostic applications of lasers in medicine.		
3.0	**Interpersonal Skills & Responsibility**		

3.1	Show responsibility for self-learning to be aware with recent developments in physics.	**1.** Ask the students to search the internet and use the library. **2.** Encourage them how to attend lectures regularly by assigning marks for attendance. **3.** Small group discussion. **4.** Give students tasks of duties. **5.** Discussion in class	**1.** Evaluate the scientific values of solutions. **2.** Evaluate the work in team **3.** Evaluation of the role of each student in group Project assignment **4.** Evaluation of student's presentations. **5.** Direct contact during office hours. **6.** Direct contact during office hours.
3.2	Show the ability to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.		
3.3	Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.		
3.4	Show some therapeutic applications of light (Photo-activation of drugs Photo-dynamic therapies Tissue engineering with light)		
4.0	**Communication, Information Technology, Numerical**		
4.1	Demonstrating capability in performing research as well as an effective oral and written communication.	**1.** Communicate effectively in writing, orally and through scientific diagrams. **2.** Preparing a report on some topics related to the course depending on web sites.	1. Evaluation of presentations 2. Evaluation of reports & Project assignment.
4.2	Acquire a working knowledge of basic research methodologies, data analysis and interpretation.	**1.** Independent study. **2.** Problem solving.	**1.** Homework **2.** Assignments.
4.3	Demonstrate effective written and oral communication skills, especially the ability to transmit complex technical information in a clear and concise manner.	**1.** Oral Presentations. **2.** Problem solving.	**1.** Homework. **2.** Assignments.
4.4	Use of the internet to research solution for relevant scientific problems.	**1.** Independent study.	**1.** Performance in problem solving. **2.** Assignments
4.5	Demonstrate enough knowledge in evaluating published works.	**1.** Independent study.	**1.** Performance in problem solving. **2.** Assignments.

5.0	Psychomotor(if any)		
5.1	N/A	N/A	N/A
5.2			

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Exercises & Home works	At the end of each chapter	10%
2	Participation in activities during lectures	All weeks	10%
3	Practical group projects	At the end of each chapter	10%
4	1st Periodic Exam	8th week	10%
5	2nd Periodic Exam	11th week	10%
6	Final Exam	16th week	50%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week) Students are supervised by academic advisers in physics Department and the time tables for academic advices were given to the student each semester. (8hrs per week).

E Learning Resources

1. List Required Textbooks • Paras N. Prasad, “Introduction to Biophotonics”, Wiley-Interscience (2003). • Ruikang K. Wang; Valery V Tuchin, "Advanced Biophotonics", CRC Press, (2013). • Gerd Keiser, “Biophotonics: Concepts to Applications”, Springer (2016). • Saleh&Teich, “Fundamentals of Photonics 2nd Ed.”, Wiley, (2007).
2. List Essential References Materials (Journals, Reports, etc.)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.
4. 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.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) Lecture room with 25 seats, equipped with a Smart Board, projector, computers and internet connection.
2. Technology resources (AV, data show, Smart Board, software, etc.) **1.** Data Show. **2.** AV Presentations. **3.** Matlab software
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) NA

G Course Evaluation and Improvement Procedures

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- Program Self study.

According to the above points the plan of improvement should be given.

Name of Course Instructor: _ Saoud Ellahyani _____

Signature: _____ Date Completed: _____

Program Coordinator: _____ Walid Belkacem Belhadj _____

Signature: _____ Date Received: _____