Course Specifications

Course Title:	Quantum Mechanics (2)
Course Code:	42031403
Program:	BSc in Physics
Department:	Department of Physics
College:	Faculty of Science
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours:	**3credit hours**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☑ Elective ☐
3. Level/year at which this course is offered:	**Seventh Level / Fourth Year**
4. Pre-requisites for this course(if any)**:**	Quantum Mechanics (1) - (42031306)
5. Co-requisites for this course(if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	36	80%
2	**Blended**	9	20%
3	**E-learning**	-	-
4	**Correspondence**	-	-
5	**Other (course project)**	-	-

7. Actual Learning Hours(based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	-
3	**Tutorial**	-
4	**Others** (specify)	-
	Total	**45**
Other Learning Hours*		
1	**Study**	15
2	**Assignments**	5
3	**Library**	15
4	**Projects/Research Essays/Theses**	5
5	**Others**(Lab reports and exam preparation time)	-
	Total	**40**

*The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course aims to extent Quantum Mechanics (1)_31031328 by offering fundamentals of non-relativistic quantum mechanics.

2. Course MainObjective

On completing this course, the students will be able to:

- Recognize the angular momentum operators.
- Explain the Stark and Zeeman effects using the time independent perturbation theory.
- Use the vibrational method to calculate the energy level of hydrogen molecule.
- Evaluate the energy of charged particle moved in magnetic field.
- State the scattering theory in quantum mechanics.

3. Course Learning Outcomes

	CLOs	AlignedPLOs
1	**Knowledge:**	
1.1	Recall angular momentumoperators, angular momentum states, angular momentum addition rules and spin.	K1
1.2	Describe approximate methods for solving the Schrödinger equation (the variational method, Stationary perturbation theory).	K1
1.3	Recognize the roll of scattering theory in developing our understanding of Quantum mechanics physical principle.	K2
2	**Skills :**	
2.1	Apply principles of quantum mechanics to obtain the matrix elements of angular momentum, Pauli matrices.	S1
2.2	Apply the vibrational method, time-independent perturbation theory to solve simple problems.	S1
2.3	Analyze and interpret the results of scattering experiments by deriving cross section, scattering amplitude, Born approximation partial waves for simple scattering systems.	S4
3	**Competence:**	
3.1	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards on assigned tasks in Quantum mechanics (2).	C1
3.12	Search in the internet and libraries about fundamental quantum mechanical processes in nature.	C3

C. Course Content

No	List of Topics	Contact Hours
	Lectures	
1	**Angular momentum operators:** Orbital angular momentum, spin angular momentum, total angular momentum, commutative relations, Eigen functions and vectors Eigen value, ladder operators, matrix representation, Pauli matrices**.**	9
2	**Time independent perturbation theory:** none degenerate cases, degeneracy, Stark effect, helium atom.	9
3	**Variation method:** Fundamental of hypothesis functions, hydrogen atom	9
4	**Motion in magnetic field:** Hamiltonian operator for charged particles moving in magnetic field, Zeeman effect, spins dynamics, interaction of atoms	9
5	**Scattering theory:** Cross section, scattering amplitude, Born approximation partial waves.	9
	Total	45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge**		
1.1	Recall angular momentumoperators, angular momentum states, angular momentum addition rules and spin.	Lectures, Open discussion	Quizzes, homeworkperiodical Exams, midterm and final exam
1.2	Describe approximate methods for solving the Schrödinger equation (the variational method, perturbation theory).	Lectures, Open discussion	Quizzes, homework periodical exams, midterm and final exam.
1.3	Recognize the roll of scattering theory in developing our understanding of physical world.	Lectures, Open discussion	Presentation, home works
2.0	**Skills**		
2.1	Apply principles of quantum mechanics to obtain the matrix elements of angular momentum, Pauli matrices.	Lectures, Open discussion	Quizzes, homework periodical exams, midterm and final exam.
2.2	Apply the vibrational method,	Lectures, Open discussion	Quizzes, homework

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
	time-independent perturbation theory and time-dependent perturbation theory to solve simple problems		periodical exams,midterm and final exam.
2.3	Analyze and interpret the results of scattering experiments by deriving cross section, scattering amplitude, Born approximation partial waves for simple scattering systems.	Lectures, Open discussion, searching the internet and library	Quizzes, homework periodical exams, midterm and final exam
3.0	**Competence**		
3.1	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards on assigned tasks in Quantum mechanics (2).	Teamwork	Worksheets, presentation
3.2	Search in the internet and libraries about fundamental quantum mechanical processes in nature.	Searching the internet and library	Presentations and homework's

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Periodical exam 1	5	10 %
2	Mid- Term exam	9	20 %
3	Periodical exam 2	13	10 %
4	Home works	During the term	10 %
5	Final theoretical Exam.	17	50 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

1. Student Academic Counseling
   - The arrangements for academic counseling and advices for the students, including scheduling of faculty office hours, advices on program planning, subjects selection and career planning are announced and published to the students in the physics department and the faculty website.
   - The students are divided into groups, whereas each student has academic counseling.
2. Student Appeals
   - The regulations for student appeals on academic matters are announced and published in the physics department and the faculty website.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	"Quantum Mechanics Concepts and Applications" , NouredineZettili, 2nd ed., 2009, by John Wiley and Sons, Ltd..
Essential References Materials	- ""Introduction to Quantum Mechanics", A. C. PHILLIPS, 2003 by John Wiley & Sons Ltd. "Essential Quantum Mechanics" , GARY E. BOWMAN,2008m by Oxford University Press Inc.
Electronic Materials	Youtube web site
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	- One classroom containing computer access, and white board.
Technology Resources (AV, data show, Smart Board, software, etc.)	- One AV. - One data show. - One Smart Board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	-

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
- Effectiveness of teaching. - The course content. - Satisfaction with the course - Quality of Learning Resources	Students	Questionnaire
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Faculty (staff member)	Observation of lectures, analysis of assessment data,
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Program Leader	Observation of lectures, interviews with involved faculty, analysis of assessment data,
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Peer Reviewer	interviews with involved faculty and course participants, analysis of assessment data,

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Quality oflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,Peer Reviewer, Others (specify)
Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	Curriculum Committee
Reference No.	
Date	

Course Specifications

Course Title:	Atomic Physics
Course Code:	42031411
Program:	BSc in Physics
Department:	Department of Physics
College:	Faculty of Science
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours:	**3 credit hours**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☑ Elective ☐
3. Level/year at which this course is offered:	**Seventh Level / Fourth Year**
4. Pre-requisites for this course(if any)**:**	**Modern Physics (42031313)**
5. Co-requisites for this course(if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	30	67%
2	**Blended**	-	-
3	**E-learning**	-	-
4	**Correspondence**	-	-
5	**Other (Laboratory)**	15	33%

7. Actual Learning Hours(based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	45
2	**Laboratory/Studio**	-
3	**Tutorial**	-
4	**Others** (specify)	-
	Total	**45**
Other Learning Hours*		
1	**Study**	15
2	**Assignments**	15
3	**Library**	15
4	**Projects/Research Essays/Theses**	-
5	**Others**(Lab reports and exam preparation time)	20
	Total	**65**

*The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The course give the students a broad knowledge of the most important characteristics of atoms and the interaction with electromagnetic field. The course describes the basic properties of atoms from non-relativistic to relativistic theory and from one- and two-electron systems to the buildup of the periodic system. The description of interaction between atoms and the electromagnet field (weak and strong) is given a particular attention.

2. Course MainObjectives:

- Understanding the physical concepts of the atomic physics and its importance in our life.
- Outlining the principles of Bohr model of single electron atoms
- Utilizing the principle of quantum theory of hydrogen atom to describe the atomic spectral series

-Recognizing the basic information of the multiple fine structure, L-S, J-J coupling energy levels in a diatomic molecule.
- Studying the Zeeman effectand Stark Effect.

3. Course Learning Outcomes

CLOs		AlignedPLOs
1	**Knowledge:**	
1.1	Recall the fundamental principles of atomic structure.	K1
1.2	Describe the different kinds of atomic models	K1, K2
1.3	List the latest development and applications in the field of atomic physics	K3
2	**Skills :**	
2.1	Explain the mono-atomic and diatomic spectra	S1
2.2	Apply appropriate mathematical concepts and computational techniques to solve problems in atomic physics field	S2
2.3	Outline the Zeeman effectand stark effect experiments	S3
2.4	Analyze and interpret atomic spectra datausing atomic structuresprinciples.	S4
3	**Competence:**	
3.1	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards on assigned tasks in atomic physics	C1
3.2	Communicate effectively orally and in writing, selecting and using forms of presentation appropriate for differing issues and audiences.	C2
3.3	Propose appropriate information and communications technology in gathering, interpreting and communicating information and ideas	C3

C. Course Content

No	List of Topics	Contact Hours
	Lectures	
1	**Atomic models:** Thomson's model,Rutherford's model,The stability of the nuclear atom, Atomic spectra, Bohr model, Reduced mass,Sommerfeld's model.	10
2	**Atomic structure:** one–electron atom(H) & two-electron atom (He), Schrödinger Equation for the Hydrogen Atom, Quantum Numbers, Selection Rules, Fine structure of H atom (spin-orbit interaction), perturbation and vibrational solutions, spectra	10
3	**Many electron atoms:** Central field approximation, The Exclusion Principle, Hund Rules, Electron Configuration and thePeriodic Table, Total Angular Momentum, L–S Coupling, J – J Coupling, Two Electron Spectra	15
4	**Magnetic and electric effects on spectral lines :** Hyperfine structure, Zeeman Effect, Stark Effect, Electron Spin Resonance (ESR)	10

No	List of Topics	Contact Hours
	Total (Lectures)	45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge**		
1.1	Recall the fundamental principles of atomic structure.	Lectures, blended learning, open discussion and brainstorming	Quizzes,homeworkperiodical Exams, midterm and final exam
1.2	Describe the different kinds of atomic models	Lectures, blended learning, open discussion and brainstorming	Quizzes, homework periodical exams, midterm and final exam.
1.3	List the latest development and applications in the field of atomic physics.	Lectures, blended learning, open discussion and brainstorming	Quizzes, homework periodical exams, midterm and final exam.
2.0	**Skills**		
2.1	Explain the monoatomic and diatomic spectra.	Lectures, blended learning, open discussion and brainstorming, Problem based learning.	Quizzes, homework periodical Exams, midterm and final exam.
2.2	Apply appropriate mathematical concepts and computational techniques to solve problems in atomic physics field.	Lectures, blended learning, open discussion and brainstorming, problem based learning,	Quizzes, homework periodical exams, midterm and final exam.
2.3	Outline the Zeeman effect and stark effect experiments.	Lectures, blended learning, open discussion and brainstorming,	Quizzes, homework periodical Exams, midterm and final exam
2.4	Analyze and interpret atomic spectra data using atomic structures principles.	Lectures, cooperative learning,brainstorming, problem based learning	Quizzes, homework periodical Exams, midterm and final exam
3.0	**Competence**		
3.1	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards on assigned tasks in atomic physics	Group working, cooperative learning, search activity	Worksheet, presentations
3.2	Communicate effectively orally and in writing, selecting and using forms of presentation appropriate for differing issues and audiences.	Group working, cooperative learning, search activity	Worksheet, presentations

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
3.3	Propose appropriate information and communications technology in gathering, interpreting and communicating information and ideas	Group working, cooperative learning, search activity	Observation card

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Periodical exam 1	5	10 %
2	Mid- Term exam	9	20 %
3	Periodical exam 2	13	10 %
4	Home works	During the term	10 %
7	Theoretical Exam	17	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

1. Student Academic Counseling
   - The arrangements for academic counseling and advices for the students, including scheduling of faculty office hours, advices on program planning, subjects selection and career planning are announced and published to the students in the physics department and the faculty website.
   - The students are divided into groups, whereas each student has academic counseling.
2. Student Appeals
   - The regulations for student appeals on academic matters are announced and published in the physics department and the faculty website.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Atomic physics, C. J. FOOT, Oxford University press, Frist edition, 2005.
Essential References Materials	H. Haken, H. C. Wolf and W. D. Brewer ”The Physics of Atoms and Quanta“, Springer-Verlag, Berlin Heidelberg, (2005).
Electronic Materials	None
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	- One classroom containing computer access, and white board
Technology Resources (AV, data show, Smart Board, software, etc.)	- One AV. - One data show. - One Smart Board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
- Effectiveness of teaching. - The course content. - Satisfaction with the course - Quality of Learning Resources	Students	Questionnaire
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Faculty (staff member)	Observation of lectures, analysis of assessment data
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Program Leader	Observation of lectures, interviews with involved faculty member, analysis of assessment data
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Peer Reviewer	interviews with involved faculty member and course participants, analysis of assessment data,

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Quality oflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,Peer Reviewer, Others (specify)
Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	Curriculum Committee
Reference No.	
Date	

Course Specifications

Course Title:	Solid State Physics (2)
Course Code:	42031413
Program:	BSc in Physics
Department:	Department of Physics
College:	Faculty of Science
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours:	**3 credit hours (2 T + 1 P)**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☑ Elective ☐
3. Level/year at which this course is offered:	**Seventh Level / Fourth Year**
4. Pre-requisites for this course(if any)**:**	**Solid State physics (1) - (42031326)**
5. Co-requisites for this course(if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	24	40%
2	**Blended**	12	20%
3	**E-learning**	-	-
4	**Correspondence**	-	-
5	**Other (Laboratory)**	24	40%

7. Actual Learning Hours(based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	32
2	**Laboratory/Studio**	28
3	**Tutorial**	-
4	**Others** (specify)	-
	Total	**60**
Other Learning Hours*		
1	**Study**	15
2	**Assignments**	15
3	**Library**	15
4	**Projects/Research Essays/Theses**	-
5	**Others**(Lab reports and exam preparation time)	20
	Total	**65**

*The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

To introduce the students to the basic concepts of solid state physics.

2. Course MainObjective

- Understand the concept of energy band in solids by applying the simple quantum mechanical concepts (Nearly free electron model)
- Recognize the optical properties of solids
- Understand the dielectric properties of solids
- Realize the magnetic properties of solids

3. Course Learning Outcomes

CLOs		AlignedPLOs
1	**Knowledge:**	
1.1	Remember the wave equation of electron in periodical potential	K1
1.2	Explain the optical transmittance, reflection and absorbance in solids	K2
1.3	Describe the dielectric and magnetic properties of solids.	K3
2	**Skills :**	
2.1	Determine the different optical and dielectric constants in solids	S1
2.2	Illustrate the frequency dependence of the dielectric Constant in solids	S2
2.3	Compare between dia, para and ferromagnetism	S3
2.4	Explain the hysteresis loop of magnetic material	S4
3	**Competence:**	
3.1	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards on assigned tasks in solid state physics.	C1
3.2	Manage a certain topic in the field of solid state physics with his classmates.	C2
....	-	

C. Course Content

No	List of Topics	Contact Hours
	Lectures	
1	**Energy bands:** Nearly free electron model, Bloch functions, Kronig-Penney model, Wave equation of electron in periodical potential.	8
2	**Optical properties:** Electromagnetic waves in crystals, optical reflection, Kramers-Kronig relation, optical constants, excitons.	6
3	**Dielectrics Properties:** Macroscopic Description, Microscopic Polarization, Local Field, Frequency Dependence of the Dielectric Constant, Ferro electricity, Piezoelectricity, Dielectric Breakdown	8
4	**Magnetism:** Macroscopic Description, Magnetic Effects in Atoms, Weak Magnetism in Solids, Diamagnetism, Diamagnetism of the Ions, Diamagnetism of Free Electrons, Para magnetism, Curie Para magnetism, Static paramagnetic susceptibility, Magnetic Ordering and Exchange Interaction, Temperature Dependence of the Ordering, Ferromagnetism Domains, Weiss field, hysteresis, Antiferromagnetic, super-exchange interaction Ferrimagnetism, structure of ferrites, Neel's theory.	10
	Total (Lectures)	32
Practical Part		

No	List of Topics	Contact Hours
1	Faraday effect	4
2	Curie Temperature	4
3	Dia-, para- and ferromagnetism	4
4	Ferromagnetic hysteresis loop	4
5	Dielectric constant	4
6	Energy band gap of metal and insulator materials	4
7	Determine the refractive index of thin films.	4
Total (practical)		28
Total (Lectures + practical)		**60**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge**		
1.1	Remember the wave equation of electron in periodical potential	Lectures, blended learning, open discussion and brainstorming	Quizzes,homeworkperiodical Exams, midterm and final exam
1.2	Explain the optical transmittance, reflection and absorbance in solids	Lectures, blended learning, open discussion and brainstorming	Quizzes, homework periodical exams, midterm and final exam.
1.3	Describe the dielectric and magnetic properties of solids.	Lectures, blended learning, open discussion and brainstorming	Quizzes, homework periodical exams, midterm and final exam.
2.0	**Skills**		
2.1	Determine the different optical and dielectric constants in solids	Lectures, blended learning, open discussion and brainstorming, Problem based learning, cooperative learning and lab working.	Quizzes, homework periodical Exams, midterm and final exam.
2.2	Illustrate the frequency dependence of the dielectric Constant in solids	Lectures, blended learning, open discussion and brainstorming, problem based learning, Cooperative learning and computer Simulated labs	Quizzes, homework periodical exams, midterm and final exam.
2.3	Compare between dia, para and ferromagnetism	brainstorming, problem based learning, cooperative learning,lab working and computer Simulated labs	Lab report, oral exam, final practical exam
2.4	Explain the hysteresis loop of magnetic material	Lectures, cooperative learning, lab working and computer Simulated labs	Quizzes, lab report, oral exam, final practical exam
3.0	**Competence**		
3.1	Demonstrate interpersonal skills of teamwork, individual responsibility for	Group working, cooperative learning	Worksheet, presentations

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
	own learning and ethical standards on assigned tasks in solid state physics.		
3.2	Manage a discussion in a certain topic in the field of solid state physics with his classmates.	Group working, cooperative learning	Worksheet, presentations
…			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Periodical exam 1	5	5 %
2	Mid- Term exam	9	10 %
3	Periodical exam 2	13	5 %
4	Home works	During the term	10 %
5	Practical (lab reports)	During the term	10 %
6	Final practical	16	10 %
7	Theoretical Exam	17	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

1. Student Academic Counseling
   - The arrangements for academic counseling and advices for the students, including scheduling of faculty office hours, advices on program planning, subjects selection and career planning are announced and published to the students in the physics department and the faculty website.
   - The students are divided into groups, whereas each student has academic counseling.
2. Student Appeals
   - The regulations for student appeals on academic matters are announced and published in the physics department and the faculty website.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	- Introduction To Solid State Physics, Kittel Charles, 8Th Edition, John Wiley& son(2005). - Solid State Physics, Hofmann P., Wiley-VCH, 2008.
Essential References Materials	The physics of solids, Richard Turton, Oxford 2000
Electronic Materials	None
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	- One classroom containing computer access, and white board ,One laboratory
Technology Resources (AV, data show, Smart Board, software, etc.)	- One AV. - One data show. - One Smart Board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
- Effectiveness of teaching. - The course content. - Satisfaction with the course - Quality of Learning Resources	Students	Questionnaire
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Faculty (staff member)	Observation of lectures, analysis of assessment data,
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Program Leader	Observation of lectures, interviews with involved faculty, analysis of assessment data,
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Peer Reviewer	interviews with involved faculty and course participants, analysis of assessment data,

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Quality oflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,Peer Reviewer, Others (specify)
Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	Curriculum Committee
Reference No.	
Date	

Course Specifications

Course Title:	Radiation Physics
Course Code:	42031415
Program:	BSc in Physics
Department:	Department of Physics
College:	**Faculty of Science**
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours:	**2credit hours**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☑ Elective ☐
3. Level/year at which this course is offered:	**Seventh level**
4. Pre-requisites for this course(if any)**:**	**Nuclear Physics (1)- (42031324)**
5. Co-requisites for this course(if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	24	80%
2	Blended	6	20%
3	E-learning	-	-
4	Correspondence	-	-
5	Other (Laboratory)	-	-

7. Actual Learning Hours(based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	30
2	Laboratory/Studio	-
3	Tutorial	-
4	Others (specify)	-
	Total	30
Other Learning Hours*		
1	Study	20
2	Assignments	10
3	Library	15
4	Projects/Research Essays/Theses	-
5	Others(Lab reports and exam preparation time)	-
	Total	45

*The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1- Course description

The goal of this course is to give a basic knowledge in radiation physics and biological effects of ionizing radiation in order to understand the principles of radiation therapy.

2. Course MainObjectives

Upon completion, successful students will be able to:

- Know the different types and sources of radiations including: Non-ionizing radiation, Ionizing radiation; Natural radiation back ground,as well as artificial radiation.
- Recognize the different Units used in Radiation Dosimetry such as: exposure dose, absorbed dose, tissue equivalent dose, effective dose, and collective dose.
- Understand the Biological Effects of Radiation.
- Acquire knowledge about Radiation detectors and Dosimeters.
- Obtain relevant information to work safely and confidently with radiation sources while maintaining the professional standard of ALARA
- Acquire knowledge about External Radiation Protection.

3. Course Learning Outcomes

CLOs		AlignedPLOs
1	**Knowledge:**	
1.1	Recall the fundamental theoretical principles and applications associated with the Radiation physics.	**K1**
1.2	Describe the physical aspects of radiation production, detection and radiation protection.	**K2**
1.3	Recognize the basic scientific facts and concepts in radiation physics and biological effects of ionizing radiation in order to understand the principles of radiation therapy.	**K3**
2	**Skills :**	
2.1	Applybasic information of radiation safety including basic principles of ionizing radiation, to understanding the risks of working with radioactive materials/radiation producing machines etc.	**S1**
2.2	Evaluate complex issues and problems related to biological factors governing radiation effects on man, the radiation exposure, and radiation shielding calculations.	**S2**
2.4	Predict the expected radiobiological outcome, when presented with the ambient conditions of irradiation (e.g. energy, dose, dose rate/fractionation, oxygen level, drugs).	**S4**
3	**Competence:**	
3.1	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards on assigned tasks inRadiation physics.	**C1**
3.2	Explore an application of radiation physics and communicate their understanding to a group of their peers in a presentation appropriate for differing audiences.	**C2**
....		

C. Course Content

No	List of Topics	Contact Hours
	Lectures	
1	**Types of Radiation and the Radioactivity:** -IONIZING VERSUS NON-IONIZING RADIATIONS: Directly ionizing radiation, indirectly ionizing radiation. -RADIOACTIVITY: Radioactive decay laws, modes of radioactive decay. -RADIATION SOURCES: Natural sources, Artificial Sources.	6
2	**Radiation Quantities and Units:** -RADIATION QUANTITIES: Exposure and exposure rate, Absorbed dose, KERMA (Kinetic Energy Release in Material), Equivalent dose, Effective dose. - CALCULATION AND MEASUREMENTS OF RADIATION QUANTITIES: Radiation weighting factor, tissue weighting factor, Conversion factors, examples of absorbed dose calculation from gamma and beta radiations.	6
3	**Radiation Detection and Measurements:** GAS-FILLED DETECTORS: Basic principles, Ionization Chambers, Proportional counters, Geiger-Muller Counters. -SEMICONDUCTOR DETECTORS: Basic principles. -SCINTILLATION DETECTORS: Basic principles, Photomultiplier tubes. -BASIC PRINCIPLES OF RADITION DOSIMETRY. -DETECTION EFFICIENCY: Components of detection efficiency, Geometric efficiency, Intrinsic efficiency, Calibration sources. -PROBLEMS IN THE DETECTIONS AND MEASUREMENTS OF β-PARTICLES. -DEAD TIME: Causes of dead time, mathematical models, window fraction effects, Dead time correction methods.	8
4	**Radiation Counting Statistics:** -TYPES OF MEASUREMENTS ERRORS. -RADIATION COUNTING STATISTICS: Poisson distribution, standard Deviation, Gaussian distribution. -PROPOGATION OF ERRORS: Sum and differences, constant multipliers, products and ratios. -APPLICATIONS OF STATISTICAL ANALYSIS: Effects of averaging, counting rates, significance of differences between counting measurements, effects of background, minimum detectable activity.	4
5	**Biological Effects of Radiation:** -EFFECTS OF RADIATION: Stochastic and Deterministic effects of radiation, Dose-Response curve, Early and Late effects. -BIOLOGICAL EFFECTS AT VARIOUS LEVELS: Direct effects (DNA damage), Indirect effects (interaction of radiation with water and production of free radicals).	2

No	List of Topics	Contact Hours
	-RBE and OEF: Relative Biological Effectiveness and Oxygen Enhancement Ratio.	
6	**Radiation Protection Principles:** -ICRP (International Commission on Radiological Protection) principle: Justifications, Optimization, ALARA (As Low As Reasonably Achievable), Dose Limits. -RULES OF PROTECTION AGAINST EXTERNAL HAZARDS: Distance, Time, Shielding, Activity. -INTERNAL CONTAMINATION: Tracks of contaminations, biological half-live time, Effective half-life time, Calculation of internal dose, -DISPOSAL OF RADIACTIVE WASTE: Rules and Managements, Survey meters and Laboratory monitors, Personal dosimeters, Wipe testing	4
	Total (Lectures)	30

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge**		
1.1	Recall the fundamental theoretical principles and applications associated with the Radiation physics.	- Lectures. - blended learning, - open discussion. - brainstorming.	- Quizzes, - homework - periodical Exams, - midterm and finalexam
1.2	Describe the physical aspects of radiation production, detection and radiation protection.	- Lectures. - blended learning, - open discussion. - brainstorming.	- Quizzes, - homework - periodical Exams, - midterm and final exam
1.3	Recognize the basic scientific facts and concepts in radiation physics and biological effects of ionizing radiation in order to understand the principles of radiation therapy.	- Lectures. - blended learning, - open discussion. - brainstorming.	- Quizzes, - homework - periodical Exams, - midterm and final exam
2.0	**Skills**		
2.1	Applybasic information of radiation safety including basic principles of ionizing radiation, to understanding the risks of working with radioactive materials/radiation producing machines etc.	- Lectures. - blended learning, - open discussion. - brainstorming. - Problem based learning, - cooperative learning.	- Quizzes, - homework - periodical Exams, - midterm and final exam
2.2	**Evalu**ate complex issues and	- Lectures. - blended learning,	- Quizzes, - homework

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
	problems related to biological factors governing radiation effects on man, the radiation exposure, and radiation shielding calculations.	- open discussion. - brainstorming. - Problem based learning, - cooperative learning.	- periodical Exams, - midterm and final exam
2.4	Predict the expected radiobiological outcome, when presented with the ambient conditions of irradiation (e.g. energy, dose, dose rate/fractionation, oxygen level, drugs).	- Lectures. - blended learning, - open discussion. - brainstorming. - Problem based learning, - cooperative learning.	- Quizzes, - homework - periodical Exams, - midterm and final exam
3.0	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards on assigned tasks in Radiation physics.		
3.1	Explore an application of radiation physics and communicate their understanding to a group of their peers in a presentation appropriate for differing audiences.	- Group working, - Cooperative learning - Discussion - Self-learning - Brainstorming.	- Assignments - Homework - Reports - Demonstrations - Observation - Written surveys - Questionnaire
3.2	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards on assigned tasks in Radiation physics.	- Group working, - Cooperative learning - Discussion - Self-learning - Brainstorming.	- Assignments - Homework - Reports - Demonstrations - Observation - Written surveys -Questionnaire
…			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Periodical exam 1	5	10 %
2	Mid- Term exam	9	20 %
3	Periodical exam 2	13	10 %
4	Home works	During the term	10 %
5	Theoretical Exam	17	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :
1. Student Academic Counseling

- The arrangements for academic counseling and advices for the students, including scheduling of faculty office hours, advices on program planning, subjects selection and career planning are announced and published to the students in the physics department and the faculty website.
- The students are divided into groups, whereas each student has academic counseling.

2. Student Appeals

- The regulations for student appeals on academic matters are announced and published in the physics department and the faculty website.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	**- J. E. Martin, 2006: Physics for Radiation and Protection – A Handbook, 2nd Edition, Wiley-VCH Verlag, Weinheim.** **- Cember H., 1996. Introduction to Health Physics. 3rd Edition, Pergamon press, New York.**
Essential References Materials	**- Glenn F. Knoll, 2011, Radiation detection and Measurements, Fourth edition, John Wiley & Sons, Inc.** -
Electronic Materials	None
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	- One classroom containing computer access, and white board.
Technology Resources (AV, data show, Smart Board, software, etc.)	- One AV. - One data show. - One Smart Board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
- Effectiveness of teaching.	• Students • Employers	• The NCAAA questionnaire (student surveys). • Employers and graduates' questionnaires. • Benchmark for the results of students against assessments at another program . • Results of competency tests.
- Planned and actual study hours. - The course contents. - Satisfaction with the course	• Students • Department council	• Observation of lectures, analysis of assessment data, • The NCAAA questionnaire

Evaluation Areas/Issues	Evaluators	Evaluation Methods
- Teaching methods.	• Independent internal or external reviewers	(student surveys). • External reviewer feedbacks. • Acquisition committee evaluation
- Achievement of course learning outcomes.	• Program Leader • Department council • Independent advisors and/or evaluator(s)	• Observation of lectures, interviews with involved faculty, analysis of assessment data. • Take the opinion of the advisory committee about the learning outcomes of the program. • Peer –review for program outcomes with other institutions program outcomes • Compare course outcomes with the outcomes of physics program in the project of higher education outcomes in the National Center for measurement • Benchmark for the results of students against assessments at another program • Results of competency tests.
- Quality of Learning Resources.	• Students • Teachers	• Reviewing the contents of textbooks mentioned in the program plan. • Suggestion more references by faculty members. • Acquisition committee evaluation Student evaluation: collected through questionnaires

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Quality oflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,Peer Reviewer, Others (specify)
Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	Curriculum Committee
Reference No.	
Date	

Course Specifications

Course Title:	Biophysics
Course Code:	42031423
Program:	BSc in Physics
Department:	Department of Physics
College:	Faculty of Science
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours:	**2credit hours**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☐ Elective ☑
3. Level/year at which this course is offered:	**Seventh Level / Fourth Year**
4. Pre-requisites for this course(if any)**:**	**General Physics (2)- (42031219)**
5. Co-requisites for this course(if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	24	80%
2	**Blended**	6	20%
3	**E-learning**	-	-
4	**Correspondence**	-	-
5	**Other (Laboratory)**	-	-

7. Actual Learning Hours(based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	30
2	**Laboratory/Studio**	-
3	**Tutorial**	-
4	**Others** (specify)	-
	Total	**30**
Other Learning Hours*		
1	**Study**	15
2	**Assignments**	10
3	**Library**	15
4	**Projects/Research Essays/Theses**	-
5	**Others**(Lab reports and exam preparation time)	-
	Total	**40**

*The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The course introduce the students to the basic concepts of Biophysics and to the role of Physics inbiology and medicine.

2. Course MainObjective

On completing of this course, students will be able to understand:

- Biomechanics and equilibrium of human body.
- Applications of Newton's laws for biological systems.
- Work and power in the human body.
- Physics of fluids and types of flow.

- Principles of heat and thermodynamics in biology.
- Biological effects of radiation and radiation in medicine and biology.

Biomedical application of sound waves.

3. Course Learning Outcomes

CLOs		AlignedPLOs
1	**Knowledge:**	
1.1	Describe the basics of fluid dynamics and its applications.	K1
1.2	Identify the roles of kinetic theory of matter, transport of molecules by diffusion, diffusion through membranes, diffusion in biology, Osmosis in biological organisms, the respiratory system.	K1, K2
1.3	Recognize, role of Sound in medicine, Ultrasound imaging, Doppler effect and blood flow measurements.	K3
1.4	Study the problems of electrical potential of cellular membrane, electrical properties of nerves, action potential, and nerve conduction.	K1, K2
2	**Skills :**	
2.1	Solve basic problems of work and energy for fluid flow problems.	S1
2.2	Calculate the sound intensity and sound impedance of different tissue.	S2
2.3	Apply the basic laws of radioactivity.	S3
2.4	Analyze data using Biophysics principles.	S4
3	**Competence:**	
3.1	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards on assigned tasks in Biophysics.	C1
3.2	Manage a certain topic in the field of Biophysics with his classmates.	C2

C. Course Content

No	List of Topics	Contact Hours
	Lectures	
1	**Introduction:** (1) INTRODUCTORY NOTICE: Outline of biophysics science and the role of Physics in biology and medicine. (2)BASIC MATHEMATICS FOR BIOLOGICAL SCIENCE: Introductory differential equations with examples of biological systems (growth rate, decay), linear and none-linear behavior.	2
2	**Forces and Newton's law of motions:** (1) EQUILIBRIUM OF HUMAN BODY: levers and biomechanics in the human body, mechanics of raising the arm, torque, and centre of gravity. (2) IMPULSE AND MOMENTUM: physics of collision, impulsive force and injury due to a fall, animal propulsion.	2
3	**Work and Energy:** -WORK AND POWER IN THE HUMAN BODY: work and power of muscles, mechanical efficiency of the heart, Treadmill exercise and cardiac stress, force generation in cells (Hill's law).	2

No	List of Topics	Contact Hours
	METABOLIC ENERGY: definition of metabolic energy, energy management in the human body, scaling relationships involving metabolic rates.	
4	**Fluids:** (1) FLUID IN STATICS: Variation of pressure with depth, Pascal principle, buoyancy force, surface tension. (2) FLUID IN MOTION: Continuity equation, Bernoulli's equation, Viscosity and Poiseuille's law. (3) FLOW OF FLUID: Types of flow (Laminar, unstable, Turbulent), Reynold's number. (4) CIRCULATION OF BLOOD: Blood pressure, control of blood, Arteriosclerosis and blood flow.	4
5	**Heat and life:** (1) IDEAL GAS LAW AND KINETIC THEORY: kinetic theory of matter, transport of molecules by diffusion, diffusion through membranes, diffusion in biology, Osmosis in biological organisms, the respiratory system. (2) HUMAN BODY TEMPERATURE: regulation of body temperature, control of skin temperature. THERMODYNAMICS: First law of thermodynamics and living organisms.	4
6	**Sound Waves and Hearing:** (1) HEARING: Physics of hearing, sound perception, Human voice, Human ear and sound detectors. (2) MEDICAL APPLICATION OF SOUND WAVES: Sound in medicine, Ultrasound imaging, Doppler effect and blood flow measurements.	4
7	**Bioelectricity:** (1) ELECTRICITY WITHIN THE BODY: Electrical potential of cellular membrane, Electrical properties of nerves, Action potential, Nerve conduction. (2) MEDICAL DIAGNOSTIC TECHNIQUES AND TREATMENTS: Electrocardiography (ECG), Electroencephalography (EEG), Electroretinography (ERG).	4
8	**Light:** (1) PHYSICS OF HUMAN EYE AND VISION: Anatomy of the human eye, Optical properties of the eye, Wavelength response of the eye, Eye accommodation and common visual defects and correction. (2) LIGHT-BASED DEVICES: Endoscopes, polarizing microscope, Applications of Laser in medicine and biology.	4
9	**Radiation:** (1) ISOTOPES AND THE HUMAN BODY: Direct effects of radiation (DNA damage), Indirect effects of radiation (free radial formation), Measurements of radiation dosimetry, Absorbed dose and relative biological effectiveness, Biological effects of ionizing radiation, Radioactive radon gas in houses. (2) RADIATION IN MEDICINE: Basics of diagnostic imaging such as radiography, Diagnostics based on nuclear effects, Radiopharmaceuticals	4

No	List of Topics	Contact Hours
	and radiation therapy of cancer.	
	Total (Lectures)	30
Total (Lectures)		**30**

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge**		
1.1	Describe the basics of fluid dynamics and its applications.	Lectures, blended learning, open discussion and brainstorming	Quizzes,homeworkperiodical Exams, midterm and final exam
1.2	Identify the roles of kinetic theory of matter, transport of molecules by diffusion, diffusion through membranes, diffusion in biology, Osmosis in biological organisms, the respiratory system.	Lectures, blended learning, open discussion and brainstorming	Quizzes, homework periodical exams, midterm and final exam.
1.3	Recognize, role of Sound in medicine, Ultrasound imaging, Doppler effect and blood flow measurements.	Lectures, blended learning, open discussion and brainstorming	Quizzes, homework periodical exams, midterm and final exam.
1.4	Study the problems of electrical potential of cellular membrane, electrical properties of nerves, action potential, and nerve conduction.	Lectures, blended learning, open discussion and brainstorming	Quizzes, homework periodical exams, midterm and final exam.
2.0	**Skills**		
2.1	Solve basic problems of work and energy for fluid flow problems.	- Problem solving - Class discussion	Quizzes, homework periodical Exams, midterm and final exam.
2.2	Calculate the sound intensity and sound impedance of different tissue.	- Problem solving - Class discussion	Quizzes, homework periodical exams, midterm and final exam.
2.3	Apply the basic laws of radioactivity.	brainstorming, problem based learning, cooperative learning,lab working and computer Simulated labs	Quizzes, homework periodical exams, midterm and final exam.
2.4	Analyze data using Biophysics principles.	Lectures, cooperative learning, lab working and	Quizzes, lab report, oral exam, final practical exam

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
		computer Simulated labs	
3.0	**Competence**		
3.1	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards on assigned tasks in solid state physics.	Group working, cooperative learning	Worksheet, presentations
3.2	Manage a discussion in a certain topic in the field of solid state physics with his classmates.	Group working, cooperative learning	Worksheet, presentations
…			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Periodical exam 1	5	10%
2	Mid- Term exam	9	20 %
3	Periodical exam 2	13	10 %
4	Home works	During the term	10 %
7	Theoretical Exam	17	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

1. Student Academic Counseling
   - The arrangements for academic counseling and advices for the students, including scheduling of faculty office hours, advices on program planning, subjects selection and career planning are announced and published to the students in the physics department and the faculty website.
   - The students are divided into groups, whereas each student has academic counseling.
2. Student Appeals
   - The regulations for student appeals on academic matters are announced and published in the physics department and the faculty website.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Biomedical Applications for Introductory Physics,J. A. Tuszynski (Author), J. M. Dixon,
Essential References Materials	Biomedical Applications for Introductory Physics,J. A.

	Tuszynski (Author), J. M. Dixon,
Electronic Materials	http://vlib.org/physics.html http://dir.yahoo.com/science/physics
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	- One classroom containing computer access, and white board ,One laboratory
Technology Resources (AV, data show, Smart Board, software, etc.)	- One AV. - One data show. - One Smart Board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
- Effectiveness of teaching. - The course content. - Satisfaction with the course - Quality of Learning Resources	Students	Questionnaire
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Faculty (staff member)	Observation of lectures, analysis of assessment data,
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Program Leader	Observation of lectures, interviews with involved faculty, analysis of assessment data,
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Peer Reviewer	interviews with involved faculty and course participants, analysis of assessment data,

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Quality oflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,Peer Reviewer, Others (specify)
Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	Curriculum Committee
Reference No.	
Date	

Course Specifications

Course Title:	Physics of thin films
Course Code:	42031425
Program:	BSc in Physics
Department:	Department of Physics
College:	Faculty of Science
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours:	**2credit hours**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☐ Elective ☑
3. Level/year at which this course is offered:	**Seventh Level / Fourth Year**
4. Pre-requisites for this course(if any)**:**	**Solid state physics (1) - (42031326)**
5. Co-requisites for this course(if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	24	80%
2	**Blended**	6	20%
3	**E-learning**	-	-
4	**Correspondence**	-	-
5	**Other**	-	-

7. Actual Learning Hours(based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	30
2	**Laboratory/Studio**	-
3	**Tutorial**	-
4	**Others** (specify)	-
	Total	**30**
Other Learning Hours*		
1	**Study**	15
2	**Assignments**	15
3	**Library**	15
4	**Projects/Research Essays/Theses**	20
5	**Others**(Lab reports and exam preparation time)	-
	Total	**65**

*The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

To introduce the students to the basic concepts of Physics of thin films.

2. Course MainObjective

- Understand the different methods of thin film deposition,
- Determine the main controlled parameters that influence the deposited film quality –
- Describe the cauterization techniques used for the fine structure study , surface probing, thickness, electrical and optical, characterization
- Outline the electrical transport Properties and applications.
- Recognize the basic concepts in the field of thin film technology.

3. Course Learning Outcomes

CLOs		AlignedPLOs
1	**Knowledge:**	
1.1	Recall the different methods of thin film deposition	K1
1.2	Describe thin film characterization, thickness measurement, transport Properties and applications.	K2
1.3	Recognize the basic concepts in the field of thin film technology..	K3
2	**Skills :**	
2.1	Explain and compare between the different methods of thin filmdeposition.	S1
2.2	Differentiate between the thin film properties and bulk properties.	S2
2.3	Conduct data analysis for Thin film properties.	S3
2.4	Analyze the processes and phenomena which happen in thin films.	S4
3	**Competence:**	
3.1	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards on assigned tasks in physics of thin film technology.	C1
3.2	Manage a certain topic in the field of physics of thin films with his classmates.	C2
....	-	

C. Course Content

No	List of Topics	Contact Hours
	Lectures	
1	**Thin Film Deposition: a. Physical Methods:** Vacuum evaporation: Types of evaporation sources, Resistive heating, electron beam evaporation, Two-source evaporation, Flash evaporation, Laser ablation, Reactive evaporation, Sputtering technique. **Chemical Methods:** Electroplating, Spray pyrolysis, chemical vapour deposition(CVD); Sol-Gel process; Screen printing, Plasma Chemical vapour deposition (PCVD),Metal organic chemical vapor deposition (MOCVD).	12
2	**Thickness measurement:** optical methods, interferometry, ellipsometry, spectral reflectometry, quartz crystal microbalances.	4
3	**Transport Properties:** Metallic films: Sources of resistivity in metallic conductors, sheet resistance and temperature coefficient of resistance of thin	6

No	List of Topics	Contact Hours
	films, Influence of thickness on the resistivity of structurally perfect thin films, Fuchs Sondhemier theory, Hall effect, Annealing, agglomeration and oxidation	
4	**Characterization:** Surface analytical techniques: X-ray Photoelectron Spectroscopy (XPS), Auger Electron Spectroscopy (AES), Secondary Ion Mass Spectroscopy (SIMS)and Rutherford Back Scattering (RBS). Imaging and optical analytic techniques: Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM). Optical analytical techniques: Fourier Transform Infrared Spectroscopy (FTIR)-Photo Luminescence (PL)	6
5	**Applications:** Thin film resistors, Thin film capacitors, Thin film solar cells, Gas sensors, Transparent conducting coatings, superconducting devices, hard coatings, Photolithography.	2
	Total (Lectures)	30

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge**		
1.1	Recall the different methods of thin film deposition	Lectures, blended learning, open discussion and brainstorming	Quizzes,homework periodical Exams, midterm and final exam
1.2	Describe thin film characterization, thickness measurement, transport Properties and applications.	Lectures, blended learning, open discussion and brainstorming	Quizzes, homework periodical exams, midterm and final exam.
1.3	Recognize the basic concepts in the field of thin film technology..	Lectures, blended learning, open discussion and brainstorming	Quizzes, homework periodical exams, midterm and final exam.
2.0	**Skills**		
2.1	Explain and compare between the different methods of thin filmdeposition.	Lectures, blended learning, open discussion and brainstorming, Problem based learning, cooperative learning and lab working.	Quizzes, homework periodical Exams, midterm and final exam.
2.2	Differentiate between the thin film properties and bulk properties.	Lectures, blended learning, open discussion and brainstorming, problem based learning, Cooperative learning and computer Simulated labs	Quizzes, homework periodical exams, midterm and final exam.
2.3	Conduct data analysis for Thin film properties.	brainstorming, problem based learning, cooperative learning,lab working and computer Simulated labs	Lab report, oral exam, final practical exam
2.4	Analyze the processes and phenomena which happen in	Lectures, cooperative learning, lab working and	Quizzes, lab report, oral exam, final practical exam

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
	thin films.	computer Simulated labs	
3.0	**Competence**		
3.1	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards on assigned tasks in Physics of thin film technology.	Group working, cooperative learning	Worksheet, presentations
3.2	Manage a discussion in a certain topic in the field of Physics of thin film with his classmates.	Group working, cooperative learning	Worksheet, presentations
…			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Periodical exam 1	5	10 %
2	Mid- Term exam	9	20 %
3	Periodical exam 2	13	10 %
4	Home works	During the term	10 %
7	Theoretical Exam	17	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

1. Student Academic Counseling
   - The arrangements for academic counseling and advices for the students, including scheduling of faculty office hours, advices on program planning, subjects selection and career planning are announced and published to the students in the physics department and the faculty website.
   - The students are divided into groups, whereas each student has academic counseling.
2. Student Appeals
   - The regulations for student appeals on academic matters are announced and published in the physics department and the faculty website.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	- Handbook of Thin-Film Technology, Hartmut Frey and Hamid R. Khan, Springer-Verlag Berlin Heidelberg 2015. - *Thin film materials technology*, KiyotakaWasa, Makoto Kitabatake, and Hideaki Adachi, 2004 by William Andrew, Inc. - Hand Book of Technologies for Films and Coatings by R. F. Bunshah, Noyespublication, 1996. - Materials Science of Thin Films, Deposition and Structure, Milton Ohring, AcademicPress (2002),
Essential References Materials	Handbook of thin-film deposition processes and techniques Principles, Methods, Equipment and Applications 2nd by Krishna Seshan Intel Corporationd, publications William Andrew publishing (2002)
Electronic Materials	None
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	- One classroom containing computer access, and white board ,One laboratory
Technology Resources (AV, data show, Smart Board, software, etc.)	- One AV. - One data show. - One Smart Board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
- Effectiveness of teaching. - The course content. - Satisfaction with the course - Quality of Learning Resources	Students	Questionnaire
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Faculty (staff member)	Observation of lectures, analysis of assessment data,
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Program Leader	Observation of lectures, interviews with involved faculty, analysis of assessment data,

Evaluation Areas/Issues	Evaluators	Evaluation Methods
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Peer Reviewer	interviews with involved faculty and course participants, analysis of assessment data,

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Qualityoflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,PeerReviewer, Others (specify)
Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	Curriculum Committee
Reference No.	
Date	

Course Specifications

Course Title:	Introduction to Plasma Physics
Course Code:	42031417
Program:	BSc in Physics
Department:	Department of Physics
College:	Faculty of Science
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours:	**2credit hours**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☑ Elective ☐
3. Level/year at which this course is offered:	**Seventh Level / Fourth Year**
4. Pre-requisites for this course(if any)**:**	**Electrodynamics (42031322)**
5. Co-requisites for this course(if any)**:**	**None**

6.Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	28	93%
2	**Blended**	-	-
3	**E-learning**	-	-
4	**Correspondence**	2	7%
5	**Other (Laboratory)**	-	-

7. Actual Learning Hours(based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	30
2	**Laboratory/Studio**	-
3	**Tutorial**	-
4	**Others** (specify)	-
	Total	**30**
Other Learning Hours*		
1	**Study**	15
2	**Assignments**	15
3	**Library**	15
4	**Projects/Research Essays/Theses**	-
5	**Others**(Lab reports and exam preparation time)	-
	Total	**45**

*The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

The primary objective of the course is to present the fundamentals of plasma physics. The course begins with an overview of plasma phenomena and their applications. The lectures cover the plasma definition, plasma parameters, plasma criteria, the concept of temperature, Debye shielding, Debye length, Coulomb collisions and different types of collisions that occur inside the gas discharge to create the plasma, DC plasmaand how it is created, Diagnostics of plasma using Langmuir single probe and electric double probe. The course also includes, some plasma applications such as, thin film deposition and sputtering yield.This allows plasma to display a host of interesting collective phenomena, the most useful and intriguing of which will be introduced in this course.

2. CourseMain Objective

- Recognizing the basic concepts of plasma physics.
- Understands the physics behind plasma and various forms of plasma.
- Understands the plasma characteristics; energy distribution function, Debye shielding, plasma frequency.
- Recognize the basics of plasma physics including collision processes, gas discharge (Townsend Discharge), breakdown and plasma formation.
- Conclude the basic laws of plasma physics (Saha equation, Debye length, forces acting on the plasma particles, and plasma frequency).
- Understands plasma oscillations and waves.
- The student's knowledge by plasma applications.

3. Course Learning Outcomes

CLOs		AlignedPLOs
1	**Knowledge:**	
1.1	Outline the scientific background and basic concepts of plasma physics	K1
1.2	Differentiate between the elastic and inelastic collisions occurred in gas discharge	K1, k2
1.3	List the latest development and applications in the field of plasma	K3
2	**Skills :**	
2.1	Plasma diagnosis using Langmuir single probe	S1
2.2	Apply appropriate mathematical concepts and computational techniques to estimate different plasma parameters	S2
2.3	Analyze and summarize information obtained fromdifferent plasma types.	S4
2.4	Interpret the subdivide regions appeared in the DC plasma discharge.	S4
3	**Competence:**	
3.1	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards on assigned tasks in physics of plasmas.	C1
3.2	Communicate effectively orally and in writing, selecting and using forms of presentation appropriate for differing issues and audiences	C2
3.3	Propose appropriate information and communications technology in gathering, interpreting and communicating information and ideas	C3

C. Course Content

No	List of Topics	Contact Hours
	Lectures	
1	Plasma definition and its types	2
2	Plasma fundamentals; temperature and energy of charged particles, distribution function in gases,quasineutrillity, collective behavior, plasma frequency, Debye length, and Debye Shielding	10
3	Elastic and inelastic collisionsin the gas discharge, absorption and emission of radiation in the gas discharge, mobility, and electrode effects in the gas discharges	8
4	Plasma formation and DC plasma	6
5	Plasma diagnosisusing Langmuir single probe	2

No	List of Topics	Contact Hours
6	Plasma applications	2
	Total (Lectures)	30

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge**		
1.1	Outline the scientific background and basic concepts of plasma physics	Lectures, Open discussion, Search activities, brain storming	Quizzes, Short exams, final exam
1.2	Differentiate between the elastic and inelastic collisions occurred in gas discharge	Lectures, Open discussion, Search activities	Quizzes, Short exams, final exam
1.3	List the latest development and applications in the field of plasma	Lectures, Open discussion, Search activities,	Quizzes, Short exams, final exam,
2.0	**Skills**		
2.1	Plasma diagnosis using Langmuir single probe	Lectures, Open discussion, Brain storming, problem solving	Exams, short quizzes
2.2	Apply appropriate mathematical concepts and computational techniques to estimate different plasma parameters	Lectures, Open discussion, Brain storming, problem solving	Exams, short quizzes
2.3	Analyze and summarize information obtained from different plasma types	Lectures, Brain storming, problem solving.	Exams, short quizzes
2.4	Interpret the subdivide regions appeared in the DC plasma discharge	Lectures, Brain storming, problem solving, working group	Exams, short quizzes
3.0	**Competence**		
3.1	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards on assigned tasks in physics of plasmas	Working group, open discussing	Worksheet, presentations
3.2	Communicate effectively orally and in writing, selecting and using forms of presentation appropriate for differing issues and audiences	Working group, open discussing	Worksheet, presentations

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
3.3	Propose appropriate information and communications technology in gathering, interpreting and communicating information and ideas	Working group, open discussing	Worksheet, presentations
…			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Periodical exam 1	5	10 %
2	Mid- Term exam	9	20 %
3	Periodical exam 2	13	10 %
4	Home works	During the term	10 %
5	Theoretical Exam	17	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

1. Student Academic Counseling
   - The arrangements for academic counseling and advices for the students, including scheduling of faculty office hours, advices on program planning, subjects selection and career planning are announced and published to the students in the physics department and the faculty website.
   - The students are divided into groups, whereas each student has academic counseling.
2. Student Appeals

   The regulations for student appeals on academic matters are announced and published in the physics department and the faculty website.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	- F. Chen: Introduction to Plasma Physics and Controlled Fusion, Vol. 1, Plasma Physics. Plenum Press 1984. - R. J. Goldston and P. H. Rutherford: Introduction to Plasma Physics, IOP Publishing Ltd. 1995. - An Introduction to GAS DISCHARGES, SECOND EDITION, A. M. HOWATSON, Fellow of Balliol College, Oxford
Essential References Materials	- Introduction to Plasma Physics: With Space and Laboratory Applications by D. A., Gurnett and A. Bhattacharjee (Paperback - Jan 31, 2005).

Electronic Materials	None
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	- One classroom containing super computer, white board
Technology Resources (AV, data show, Smart Board, software, etc.)	- One AV. - One data show. - One Smart Board. - Printer. - Scanner.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	None

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
- Effectiveness of teaching. - The course content. - Satisfaction with the course - Quality of Learning Resources	Students	Questionnaire
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Faculty (staff member)	Observation of lectures, analysis of assessment data,
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Program Leader	Observation of lectures, interviews with involved faculty, analysis of assessment data,
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Peer Reviewer	Interviews with involved faculty and course participants, analysis of assessment data,

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Qualityoflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,PeerReviewer, Others (specify)

Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	Curriculum Committee
Reference No.	
Date	

Course Specifications

Course Title:	Advanced Laboratory Techniques
Course Code:	42031427
Program:	BSc in Physics
Department:	Department of Physics
College:	Faculty of Science
Institution:	AlBaha University

Table of Contents

A. Course Identification

1. Credit hours:	**2credit hours**
2. Course type	
a.	University ☐ College ☐ Department ☑ Others ☐
b.	Required ☐ Elective ☑
3. Level/year at which this course is offered:	**Seventh Level / Fourth Year**
4. Pre-requisites for this course(if any)**:**	**Solid state Physics (1) - (42031326)**
5. Co-requisites for this course(if any)**:**	**None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	24	80%
2	**Blended**	6	20%
3	**E-learning**	-	-
4	**Correspondence**	-	-
5	**Other (course project)**	-	-

7. Actual Learning Hours(based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	6
2	**Laboratory/Studio**	24
3	**Tutorial**	-
4	**Others** (specify)	-
	Total	**30**
Other Learning Hours*		
1	**Study**	15
2	**Assignments**	15
3	**Library**	15
4	**Projects/Research Essays/Theses**	-
5	**Others**(Lab reports and exam preparation time)	-
	Total	**45**

*The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course is designed to study and introduce the basic principles of laboratories and is focusing on experimental data processing which is the basics of modern physics, design, assemble, and perform experiments, data analysis, errors calculations and problem solving.

2. Course MainObjectives

On completing this course, the students will be able to:

1- Understand the experimental results that are the underpinnings of modern physics
2- Design, assemble, and perform experiments.
3- Learn how to connect textbook physics to the world of experiment.
4- Develop good laboratory record-keeping practices

5- Develop skills in data analysis, errors calculations and problem solving.
6- Give a survey, via experimenting, of the sub-fields of modern physics, and the pertinent experimental issues in each.
7- Write a professional laboratory report.

3. Course Learning Outcomes

CLOs		AlignedPLOs
1	**Knowledge:**	
1.1	Describe experiments that are the underpinnings of modern physics	K1
1.2	Understand the experimental results	K2
1.3	Connect textbook physics to the world of experiment	K3
2	**Skills :**	
2.1	Design, assemble, and perform experiments	S1
2.2	Develop skills in data analysis, errors calculations and problem solving	S2
2.3	Write a professional laboratory report	S4
3	**Competence:**	
3.1	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards	C1
3.2	Manage to elucidate fundamental questions related to modern physics and be able to discuss them with his/her classmates.	C2

C. Course Content

No	List of Topics	Contact Hours
	Lectures	
1	**Introduction:** Measurement, Errors, data analysis, Lab partner selections and experiment selections should be made in consultation with the instructor.	3
2	**Experiment No. 1** To be selected in the field of Electronics	6
3	**Experiment No. 2** To be selected in the field of Solid State Physics	6
4	**Experiment No. 3** To be selected in the field of Laser Physics	6
5	**Experiment No. 4** To be selected in the field of Nuclear Physics.	6
6	**Discussion**	3
	Total	30

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	TeachingStrategies	AssessmentMethods
1.0	**Knowledge**		
1.1	Describe experiments that are the underpinnings of modern physics	Lectures Brainstorming	Quizzes, homeworkperiodical Exams, midterm and final exam
1.2	Understand the experimental results	Brainstorming	Quizzes, homework periodical exams, midterm and final exam.
1.3	Connect textbook physics to the world of experiment	Blended learning Open discussion	Quizzes, homework periodical exams, midterm and final exam.
2.0	**Skills**		
2.1	Design, assemble, and perform experiments	Experimentation Test-Error	Quizzes, homework periodical exams, midterm and final exam.
2.2	Develop skills in data analysis, errors calculations and problem solving	Cooperative learning Simulated labs	Quizzes, homework periodical exams, midterm and final exam.
2.3	Write a professional laboratory report	Open discussion Brainstorming, Cooperative learning	Quizzes, homework periodical exams, midterm and final exam.
3.0	**Competence**		
3.1	Demonstrate interpersonal skills of teamwork, individual responsibility for own learning and ethical standards	Group working Cooperative learning	Worksheet, presentations
3.2	Manage to elucidate fundamental questions related to advanced laboratories techniques and be able to discuss them with his/her classmates.	Group working Cooperative learning	Worksheet, presentations

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Pre-lab questions and Lab performance	During the term	20 %
2	Notebook checks	During the term	15 %
3	Homework / Assignments / Quizzes	During the term	15 %
4	Lab Reports	5, 8, 11, 14	40 %
5	Oral Presentation	15	10 %

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

1. Student Academic Counseling
   - The arrangements for academic counseling and advices for the students, including scheduling of faculty office hours, advices on program planning, subjects selection and career planning are announced and published to the students in the physics department and the faculty website.
   - The students are divided into groups, whereas each student has academic counseling.
2. Student Appeals
   - The regulations for student appeals on academic matters are announced and published in the physics department and the faculty website.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	• John R. Taylor, An Introduction to Error Analysis, 2nd ed. (University Science Books, Mill Valley, CA, 1997). • C. Melissinos, "Experiments in Modern Physics," Academic Press, Second Edition, • P. H. Bevington and D. K. Robinson, "Data Reduction and Error Analysis for the Physical Sciences," McGraw Hill, 1992.
Essential References Materials	None
Electronic Materials	None
Other Learning Materials	None

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	- One classroom containing computer access, and white board.
Technology Resources (AV, data show, Smart Board, software, etc.)	- One AV. - One data show. - One Smart Board.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	Equipped physics laboratory (there is not a standard, advanced labs to be performed are the more relevant experiments in modern physics, e.g. : Electron-Spin resonance/Nuclear-Magnetic resonance/ Zeeman-Effect/ X-Ray apparatus, etc...

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
- Effectiveness of teaching. - The course content. - Satisfaction with the course - Quality of Learning Resources	Students	Questionnaire
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Faculty (staff member)	Observation of lectures, analysis of assessment data,
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Program Leader	Observation of lectures, interviews with involved faculty, analysis of assessment data,
- Teaching methods. - Planned and actual study hours. - Achievement of course learning outcomes.	Peer Reviewer	interviews with involved faculty and course participants, analysis of assessment data,

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes,Quality oflearning resources, etc.)
Evaluators (Students,Faculty, Program Leaders,Peer Reviewer, Others (specify)
Assessment Methods(Direct, Indirect)

H. Specification Approval Data

Council / Committee	Curriculum Committee
Reference No.	
Date	