Sana'a University
Faculty of Engineering
Mechatronics Engineering Department
Mechatronics Engineering Program

Course Specification of Physics

I. Course Identification and General Information:

1.	Course Title:	Physics.				
2.	Course Code & Number:	BR001.				
3.	Credit hours:	C.H				TOTAL Credit Hours
		Th.	Seminar	Pr.	Tu.	
		2	-	2	2	4
4.	Study level/ semester at which this course is offered:	First Year-First Semester.				
5.	Pre –requisite (if any):	Nil				
6.	Co –requisite (if any):	Mathematics 1				
7.	Program (s) in which the course is offered:	Mechatronics Engineering Program.				
8.	Language of teaching the course:	English Language.				
9.	Location of teaching the course:	Mechatronics Engineering Department.				
10.	Prepared By:	Ass. Prof. Dr. Riyad A. Muharram.				
11.	Date of Approval:					

II. Course Description:

This course introduces fundamental principles and concepts of theoretical and practical physics of importance to Mechatronic engineering, and their applications. Topics include: units, vectors, Newtonian mechanics, work and energy and their applications, fluids mechanics, heat, electricity and magnetism, calculating the energy stored in electric and magnetic fields, basic wave properties, light and sound.

Prepared by	Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance
Ass. Prof. Dr. Riyad Muharram	Ass. Prof. Dr. Abdul-Malik Momin	Ass. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Ass. Prof. Dr. Huda Al-Emad

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III.	Course Intended learning outcomes (CILOs) of the course	Referenced PILOs
a.1	Define knowledge of, Physics sciences and its applications in the field of Mechatronics Engineering.	A1
a.2	Describe methodologies for data collection and describe characteristics of engineering materials related to Mechatronics through physical science.	A3, A4
b.1	Explore theories, rules and basic concepts to interpret physical events to formulate and solve Mechatronics problems using suitable methods.	B1, B5
c1	Conduct experiments safely to verify theoretical concepts related to physics.	C1
c.2	Employ standard specifications while designing and integrating work in the physics lab.	C5
d.1	Assess proficiency in the evaluation and integration of information and processes in project work.	D1
d.2	Defend acquisition of new knowledge as a part of life- long learning strategy.	D5
d.3	Review a search of literature and use databases and other sources of information.	D7

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1. Define knowledge of, Physics sciences and it's applications in the field of Mechatronics Engineering.	Lecture Tutorial	Written examination for assessment of knowledge and understanding.

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a2. Describe methodologies for data collection and describe characteristics of engineering materials related to Mechatronics through physical science.	Lecture Tutorial / demonstration Discussions	Problem set. Partial and total work assessment**.**

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1- Explore theories, rules and basic concepts to interpret physical events to formulate and solve Mechatronics problems using suitable methods.	General lecture on the practical techniques used in the lab.	Reports on experiments.

© Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c.1. Conduct experiments safely to verify theoretical concepts related to physics.	Theoretical introduction and experimental procedure on experiments will be explained by lab assistances using power point representation	Quizzes (Weekly) to assess ability to solve problems and analyze results independently
c.2. Employ standard specifications while designing and integrating work in the physics lab.	Lecture demonstration	Problem set – assignment Partial and total work assessment

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(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d.1. Assess proficiency in the evaluation and integration of information and processes in project work.	Active lectures. Independent learning.	Write reports and essay presentations.
d.2. Defend acquisition of new knowledge as a part of life- long learning strategy.	Active lectures. Independent learning.	Tests and presentations. Scientific research work.
d.3. Review a search of literature and use databases and other sources of information	Active lectures. Independent learning	Tests and presentations. Scientific research work.

IV. Course Content:

A- Theoretical Aspect:

Order	Topic List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1.	Introduction to Physics and Measurements.	a1, a2,b1.	Introduction, Units, Conversions, Dimensional Analysais, Vectors	1	2
2.	Motion.	a1, a2,b1,c1,c2, d1,d2,d3.	In One-Dimension, In Two-Dimension, Circular Motion	1	2
3.	Newton's Laws.	a1, a2,b1,c1,c2, d1,d2,d3.	Linear Momentum – Central Force – Friction Force – Gravitational Force	1	2

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Ass. Prof. Dr.
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4.	Work and Energy.	a1, a2,b1,c1,c2, d1,d2,d3.	The Work Done – Kinetic Energy – Potential Energy – Power	1	2
5.	Fluid Mechanics.	a1, a2,b1,c1,c2, d1,d2,d3.	Fluid Flow	1	2
6.	Heat Transfer.	a1, a2,b1,c1,c2, d1,d2,d3.	Thermal Processes	1	2
7.	Electrostatic Field.	a1, a2,b1,c1,c2, d1,d2,d3.	Coulomb's Law – Electric Field Produced from Charge Distribution (Point and Continuous) – Charge Moving in E	1	2
8.	Mid-Term Exam.	a1, a2, b1, c1, c2.	The First 7 Chapters.	1	2
9.	Electric Flux.	a1, a2,b1,c1,c2, d1,d2,d3.	Gauss's Law –Applications - Electric Potential – Equipotential Surfaces	1	2
10.	Capacitors.	a1, a2,b1,c1,c2, d1,d2,d3.	Capacitor Components – Capacitance Calculations – The Energy Stored In Capacitors – Combination Of Capacitors	1	2
11.	Magnetic Field.	a1, a2,b1,c1,c2, d1,d2,d3.	The Magnetic Field – Behavior Of Charge Particles in Magnetic Field	1	2
12.	Faraday's Law Of Induction.	a1, a2,b1,c1,c2, d1,d2,d3.	Motional emf – Induced emf and Electric Fields – Generators and Motors	1	2
13.	Inductance.	a1, a2,b1,c1,c2, d1,d2,d3.	Self-Inductance – Energy Stored In The Magnetic Field – Mutual Inductance	1	2
14.	Sound and Light.	a1, a2,b1,c1,c2, d1,d2,d3	Wave Motion, Sound Waves, Doppler's Effect, Linear superposition	1	2

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15.	Photoelectric Effect.	a1, a2,b1,c1,c2, d1,d2,d3.	Interaction Between Light and Matter	1	2
16.	Final Exam	a1, a2, b1, c1, c2.	All the Chapters.	1	2
Number of Weeks /and Units Per Semester				**16**	**32**

B – Tutorial Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes
1.	Introduction to Physics and Measurements.	1	2	a1, a2,b1.
2.	Motion.	1	2	a1, a2,b1,c1,c2, d1,d2,d3.
3.	Newton's Laws.	1	2	a1, a2,b1,c1,c2, d1,d2,d3.
4.	Work and Energy.	1	2	a1, a2,b1,c1,c2, d1,d2,d3.
5.	Fluid Mechanics.	1	2	a1, a2,b1,c1,c2, d1,d2,d3.
6.	Heat Transfer.	1	2	a1, a2,b1,c1,c2, d1,d2,d3.
7.	Electrostatic Field.	1	2	a1, a2,b1,c1,c2, d1,d2,d3.
8.	Electric Flux.	1	2	a1, a2,b1,c1,c2, d1,d2,d3.
9.	Capacitors.	1	2	a1, a2,b1,c1,c2, d1,d2,d3.
10.	Magnetic Field.	1	2	a1, a2,b1,c1,c2, d1,d2,d3.
11.	Faraday's Law Of Induction.	1	2	a1, a2,b1,c1,c2, d1,d2,d3.
12.	Inductance.	1	2	a1, a2,b1,c1,c2, d1,d2,d3.
13.	Sound and Light.	1	2	a1, a2,b1,c1,c2, d1,d2,d3
14.	Photoelectric Effect.	1	2	a1, a2,b1,c1,c2, d1,d2,d3.
Number of Weeks /and Units Per Semester		**14**	**28**	

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C - Practical Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes
1.	Experiment of Measurements Tools and Devices	1	2	a1, a2,b1,c1,c2, d1,d2,d3.
2.	Verification of Newton's Laws	1	2	a1, a2,b1,c1,c2, d1,d2,d3.
3.	Validation of Energy Conservation	1	2	a1, a2,b1,c1,c2, d1,d2,d3
4.	Calculation the Viscosity of the Fluid	1	2	a1, a2,b1,c1,c2, d1,d2,d3
5.	Determining the Specific Heat of a material	1	2	a1, a2,b1,c1,c2, d1,d2,d3
6.	Experiments to Calculate the Electric Field, Electric Force, and Electric Potential for a system of Charges	2	4	a1, a2,b1,c1,c2, d1,d2,d3
7.	Calculation the Capacitance and Energy Stored For a group of Capacitors	1	2	a1, a2,b1,c1,c2, d1,d2,d3
8.	Temperature dependent resistivity	1	2	a1, a2,b1,c1,c2, d1,d2,d3
9.	Determining the Deflection Force on a Charge moving in a magnetic Field	1	2	a1, a2,b1,c1,c2, d1,d2,d3
10.	Experiment of Faraday's Law of Induction	1	2	a1, a2,b1,c1,c2, d1,d2,d3
11.	Calculation the Speed of Sound in Air	1	2	a1, a2,b1,c1,c2, d1,d2,d3
12.	Spectrometer Analyzer (Light Analyzing Using a prism)	1	2	a1, a2,b1,c1,c2, d1,d2,d3
13.	Experiment of Light Interaction with Matters	1	2	a1, a2,b1,c1,c2, d1,d2,d3
Number of Weeks /and Units Per Semester		**14**	**28**	

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V. Teaching strategies of the course:

- Class Room Lectures.
- Power Point Lectures.
- Lab. Works.
- Solved Problems.
- Tutorials.
- Independent Study.

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Problems solving (Assignments of all topic list).	a1, a2,b1,c1,c2, d1,d2,d3	2-13	5
2.	Theory part.	a1, a2,b1,c1,c2, d1,d2,d3	7	10
3.	Experiments part.	a1, a2,b1,c1,c2, d1,d2,d3	14	10
4.	Class activity.	a1, a2,b1,c1,c2, d1,d2,d3	2-13	10
Total				**35**

VII. Schedule of Assessment Tasks for Students During the Semester:

No	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Exercises & Home Works.	Weekly	35	17.5 %	a1, a2, ,b1,c1,c2, d1, d2,d3.
2.	Quizzes.	Two times randomly	10	5 %	a1, a2, b1,c1, c2

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3.	Written Test (Mid Term).	8	15	7.5 %	a1, a2, b1, c1, c2,
4.	Final Exam (practical).	14	20	10 %	a1, a2, b1, c1, c2,
5.	Final Exam (theoretical).	16	120	60 %	a1, a2, b1, c1, c2.
	Sum.		**200**	**100 %**	

VIII. Learning Resources:

- Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).

1- Required Textbook(s) (maximum two).

1- Raymond A.Serway, Robert J.Beichner and John W.Jewett, Jr. – 2000 – Physics For Scientists and Engineers With Modern Physics – 5th Edition – Saunders College Publishing

2- Essential References.

1- F.W. Seas, M.W. Zemansky and H.D. Young – 2003 - University Physics – Addison – Wesley Company

3- Recommended Books and Reference Materials.

1- David Halliday and Robert Resnick – 2007 – Fundamentals of Physics – 7th edition – John Willey Co.

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	IX. Course Policies:
1.	**Class Attendance:** The students should have more than 75 % of attendance according to rules and regulations of the faculty.
2.	**Tardy:** The students should respect the timing of attending the lectures. They should attend within 1 minutes from starting of the lecture.
3.	**Exam Attendance/Punctuality:** The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for midterm exam and final exam.
4.	**Assignments & Projects:** The assignment is given to the students after each chapter, the student has to submit all the assignments for checking on time.
5.	**Cheating**: If any cheating occurred during the examination, the student is not allowed to continue and he/she has to face the examination committee for enquires.
6.	**Plagiarism**: The student will be terminated from the Faculty, if one student attends the exam on another behalf according to the policy, rules and regulations of the university.
7.	**Other policies:**

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	-All the teaching materials should be kept out the examination hall. -The mobile phone is not allowed. -There should be a respect between the student and his teacher.

Reviewed By	Vice Dean for Academic Affairs and Post Graduate Studies: Dr. Tarek A. Barakat President of Quality Assurance Unit: Ass. Prof. Dr. Mohammed Algorafi Head of Mechatronics Engineering Department: Ass. Prof. Dr. Abdul-Malik Momin
	Deputy Rector for Academic Affairs Dr. Ibrahim AlMutaa Ass. Prof. Dr. Ahmed Mujahed Dr. Munaser Alsubri

Template for Course Plan of Physics

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I- Information about Faculty Member Responsible for the Course:

		Office Hours					
Name	Ass. Prof. Dr. Riyad A.M. Muharam						
Location& Telephone No.	Faculty of Engineering -Sana'a 770-521-271	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	DrRiyad@yahoo.com	2				2	

II. Course Identification and General Information:

1-	**Course Title:**	Physics.				
2-	**Course Number & Code:**	BR001.				
3-	**Credit hours:**	C.H				TOTAL Credit Hours
		Th.	Seminar	Pr.	Tu.	
		2	-	2	2	4
4-	**Study level/year at which this course is offered:**	First Year – First Semester.				
5-	**Pre –requisite (if any):**	Nil				
6-	**Co –requisite (if any):**	Mathematics 1				
7-	**Program (s) in which the course is offered**	Mechatronics Engineering Program.				
8-	**Language of teaching the course:**	English Language.				
9-	**System of Study:**	Semesters.				
10-	**Mode of delivery:**	Lectures, Tutorials and Lab.				
11-	**Location of teaching the course:**	Mechatronics Engineering Department.				

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III. Course Description:

This course introduces fundamental principles and concepts of theoretical and practical physics of importance to Mechatronic engineering, and their applications. Topics include: units, vectors, Newtonian mechanics, work and energy and their applications, fluids mechanics, heat, electricity and magnetism, calculating the energy stored in electric and magnetic fields, basic wave properties, light and sound.

IV. Course Intended learning outcomes (CILOs) of the course		Referenced PILOs
a.1	Define knowledge of, Physics sciences and its applications in the field of Mechatronics Engineering.	A1
a.2	Describe methodologies for data collection and describe characteristics of engineering materials related to Mechatronics through physical science.	A3, A4
b.1	Explore theories, rules and basic concepts to interpret physical events to formulate and solve Mechatronics problems using suitable methods.	B1, B5
c1	Conduct experiments safely to verify theoretical concepts related to physics.	C1
c.2	Employ standard specifications while designing and integrating work in the physics lab.	C5
d.1	Assess proficiency in the evaluation and integration of information and processes in project work.	D1
d.2	Defend acquisition of new knowledge as a part of life- long learning strategy.	D5
d.3	Review a search of literature and use databases and other sources of information.	D7

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V. Course Content:

A- Theoretical Aspect:

Order	Topic List	Sub Topics List	Number of Weeks	Contact hours
1.	Introduction to Physics and Measurements.	Introduction, Units, Conversions, Dimensional Analysais, Vectors	1	2
2.	Motion.	In One-Dimension, In Two-Dimension, Circular Motion	2	2
3.	Newton's Laws.	Linear Momentum – Central Force – Friction Force – Gravitational Force	3	2
4.	Work and Energy.	The Work Done – Kinetic Energy – Potential Energy – Power	4	2
5.	Fluid Mechanics.	Fluid Flow	5	2
6.	Heat Transfer.	Thermal Processes	6	2
7.	Electrostatic Field.	Coulomb's Law – Electric Field Produced from Charge Distribution (Point and Continuous) – Charge Moving in E	7	2
8.	Mid-Term Exam.	The First 7 Chapters.	8	2
9.	Electric Flux.	Gauss's Law –Applications - Electric Potential – Equipotential Surfaces	9	2
10.	Capacitors.	Capacitor Components – Capacitance Calculations – The Energy Stored in Capacitors – Combination Of Capacitors	10	2
11.	Magnetic Field.	The Magnetic Field – Behavior of Charge Particles in Magnetic Field	11	2
12.	Faraday's Law Of Induction.	Motional emf – Induced emf and Electric Fields – Generators and Motors	12	2
13.	Inductance.	Self-Inductance – Energy Stored in The Magnetic Field – Mutual Inductance	13	2

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14.	Sound and Light.	Wave Motion, Sound Waves, Doppler's Effect, Linear superposition	14	2
15.	Photoelectric Effect.	Interaction Between Light and Matter	15	2
16.	Final Exam	All the Chapters.	16	2
Number of Weeks /and Units Per Semester			**16**	**32**

B – Tutorial Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes
1.	Introduction to Physics and Measurements.	1	2	a1, a2,b1.
2.	Motion.	2	2	a1, a2,b1,c1,c2, d1,d2,d3.
3.	Newton's Laws.	3	2	a1, a2,b1,c1,c2, d1,d2,d3.
4.	Work and Energy.	4	2	a1, a2,b1,c1,c2, d1,d2,d3.
5.	Fluid Mechanics.	5	2	a1, a2,b1,c1,c2, d1,d2,d3.
6.	Heat Transfer.	6	2	a1, a2,b1,c1,c2, d1,d2,d3.
7.	Electrostatic Field.	7	2	a1, a2,b1,c1,c2, d1,d2,d3.
8.	Electric Flux.	8	2	a1, a2,b1,c1,c2, d1,d2,d3.
9.	Capacitors.	9	2	a1, a2,b1,c1,c2, d1,d2,d3.
10.	Magnetic Field.	10	2	a1, a2,b1,c1,c2, d1,d2,d3.
11.	Faraday's Law of Induction.	11	2	a1, a2,b1,c1,c2, d1,d2,d3.
12.	Inductance.	12	2	a1, a2,b1,c1,c2, d1,d2,d3.
13.	Sound and Light.	13	2	a1, a2,b1,c1,c2, d1,d2,d3
14.	Photoelectric Effect.	14	2	a1, a2,b1,c1,c2, d1,d2,d3.
Number of Weeks /and Units Per Semester		**14**	**28**	

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C - Practical Aspect:

Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes
1.	Experiment of Measurements Tools and Devices	1	2	a1, a2,b1,c1,c2, d1,d2,d3.
2.	Verification of Newton's Laws	2	2	a1, a2,b1,c1,c2, d1,d2,d3.
3.	Validation of Energy Conservation	3	2	a1, a2,b1,c1,c2, d1,d2,d3
4.	Calculation the Viscosity of the Fluid	4	2	a1, a2,b1,c1,c2, d1,d2,d3
5.	Determining the Specific Heat of a material	5	2	a1, a2,b1,c1,c2, d1,d2,d3
6.	Experiments to Calculate the Electric Field, Electric Force, and Electric Potential for a system of Charges	6,7	4	a1, a2,b1,c1,c2, d1,d2,d3
7.	Calculation the Capacitance and Energy Stored For a group of Capacitors	8	2	a1, a2,b1,c1,c2, d1,d2,d3
8.	Temperature dependent resistivity	9	2	a1, a2,b1,c1,c2, d1,d2,d3
9.	Determining the Deflection Force on a Charge moving in a magnetic Field	10	2	a1, a2,b1,c1,c2, d1,d2,d3
10.	Experiment of Faraday's Law of Induction	11	2	a1, a2,b1,c1,c2, d1,d2,d3
11.	Calculation the Speed of Sound in Air	12	2	a1, a2,b1,c1,c2, d1,d2,d3
12.	Spectrometer Analyzer (Light Analyzing Using a prism)	13	2	a1, a2,b1,c1,c2, d1,d2,d3
13.	Experiment of Light Interaction With Matter	14	2	a1, a2,b1,c1,c2, d1,d2,d3
Number of Weeks /and Units Per Semester		**14**	**28**	

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VI. Teaching strategies of the course:

- Class Room Lectures.
- Power Point Lectures.
- Lab. Works.
- Solved Problems.
- Tutorials.
- Independent Study.

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Problems solving (Assignments of all topic list).	a1, a2,b1,c1,c2, d1,d2,d3	2-13	5
2.	Theory part.	a1, a2,b1,c1,c2, d1,d2,d3	7	10
3.	Experiments part.	a1, a2,b1,c1,c2, d1,d2,d3	14	10
4.	Class activity.	a1, a2,b1,c1,c2, d1,d2,d3	2-13	10
Total				**35**

VIII. Schedule of Assessment Tasks for Students During the Semester:

No	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Exercises & Home Works.	Weekly	35	17.5 %	a1, a2, ,b1,c1,c2, d1, d2,d3.
2.	Quizzes.	Two times randomly	10	5 %	a1, a2, b1,c1, c2
3.	Written Test (Mid Term).	8	15	7.5 %	a1, a2, b1, c1, c2,

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4.	Final Exam (practical).	14	20	10 %	a1, a2, b1, c1, c2,
5.	Final Exam (theoretical).	16	120	60 %	a1, a2, b1, c1, c2.
	Sum.		**200**	**100 %**	

IX. Learning Resources:

- Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).

1- Required Textbook(s) (maximum two).

2- Raymond A.Serway, Robert J.Beichner and John W.Jewett, Jr. – 2000 – Physics For Scientists and Engineers With Modern Physics – 5th Edition – Saunders College Publishing

2- Essential References.

2- F.W. Seas, M.W. Zemansky and H.D. Young – 2003 - University Physics – Addison – Wesley Company

3- Recommended Books and Reference Materials.

2- David Halliday and Robert Resnick – 2007 – Fundamentals of Physics – 7th edition – John Willey Co.

X. Course Policies:

1.	**Class Attendance:** The students should have more than 75 % of attendance according to rules and regulations of the faculty.
2.	**Tardy:** The students should respect the timing of attending the lectures. They should attend within 1 minutes from starting of the lecture.
3.	**Exam Attendance/Punctuality:**

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	The student should attend the exam on time. The punctuality should be implemented according to rules and regulations of the faculty for midterm exam and final exam.
4.	**Assignments & Projects:** The assignment is given to the students after each chapter, the student has to submit all the assignments for checking on time.
5.	**Cheating**: If any cheating occurred during the examination, the student is not allowed to continue and he/she has to face the examination committee for enquires.
6.	**Plagiarism**: The student will be terminated from the Faculty, if one student attends the exam on another behalf according to the policy, rules and regulations of the university.
7.	**Other policies:** -All the teaching materials should be kept out the examination hall. -The mobile phone is not allowed. -There should be a respect between the student and his teacher.

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