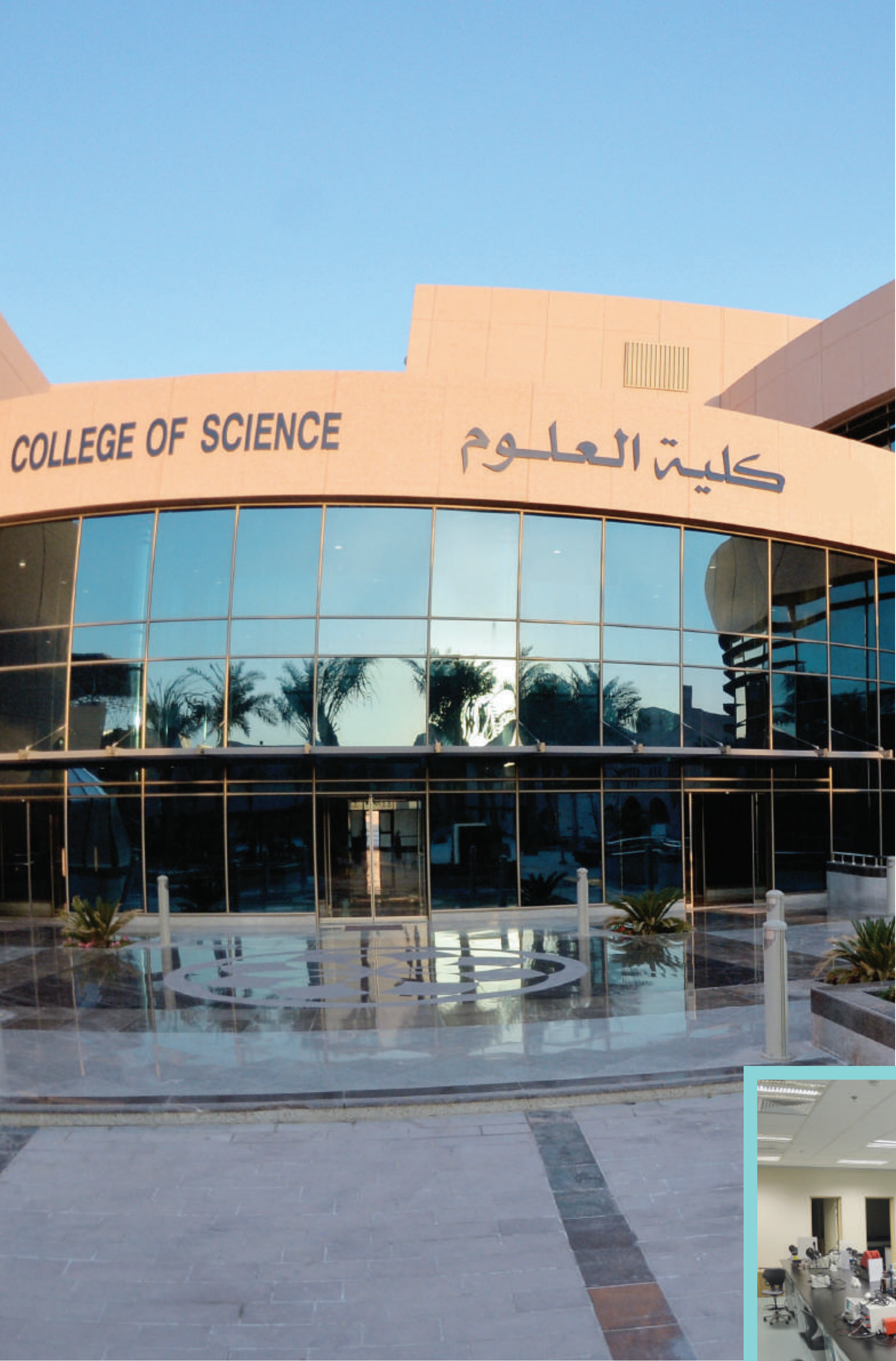
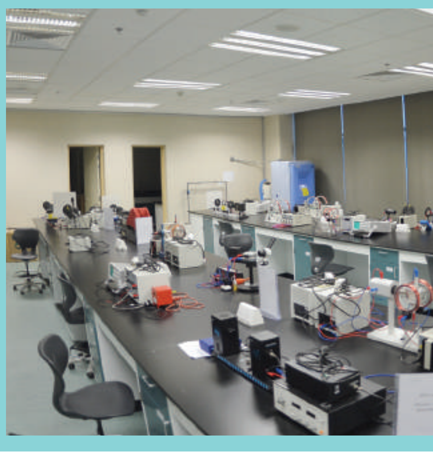


KING FAISAL UNIVERSITY
COLLEGE OF SCIENCE
MATHEMATICS AND
STATISTICS DEPARTMENT



Course Catalogue
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Course Name	General Physics 1				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 101	0824101	1	3	-
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

General physics (I) is an introductory physics course that covers kinematics, vector analysis, force dynamics, kinematics and dynamics of circular motion, work, energy, linear momentum, collisions, rotational kinematics, angular momentum, static equilibrium, elastic properties of solids, and fluid dynamics.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define the most fundamental principles of physics and their applications that are listed in the course content.
2. Recognize the concepts of work, energy and their applications, linear and angular momenta, as well as the rotational kinematics.
3. Outline static equilibrium and elastic properties of solids.
4. Recognize the concepts of fluid mechanics.
5. Define the rotational torque and identify its relation to the moment of inertia.
6. Develop strong problem-solving strategies and self-study skills.
7. Analyze basic laws of mechanics, energy, linear and angular momentum, torque and fluid mechanics.
8. Explain the concept of energy conservation.
9. Interpret Bernoulli equation and write the statement of energy density conservation in fluid dynamics.
10. Develop student’s conceptual and analytical understanding of physics, Encourage students curiosity in mathematics, improve their skills on setting up mathematical description of physical problems, and develop students learning and reading skills.
11. Use students' communication and independent working skills to help them to be individualistic and develop student’s ability to be a team player.

Assessment Policy	**Assignment**	10%	**Quiz**	20%	**Lab**	-	**Project**	-
	Midterm	30%	**Final**	40%	**Others**	-		

Textbook	Physics for Scientists and Engineers with Modern Physics. Raymond A. Serway and John W. Jewett, 10th Edition, by Cengage Learning US (2018).
References	David Halliday and Robert Resnick, Fundamentals of Physics, Wiley, 10th ed., (2013).

<table>
<tr><td>Course Name</td><td colspan="3">General Physics 1 Lab</td><td colspan="2"></td></tr>
<tr><td>Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite</td></tr>
<tr><td></td><td>Phys 111</td><td>0824111</td><td>1</td><td>1</td><td>-</td></tr>
<tr><td>Course Track</td><td colspan="5">☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
</table>

Course Description

This course covers the following topics: The concepts of basic measurements, Hooke's Law, balance of forces, equilibrium at incline surface, energy conservation during free fall, Linear Momentum, circular motion and angular acceleration, torque, pressure, viscosity of fluids, surface tension and Archimedes' principle.

Course Outcomes

After the completion of this course, the student will be able to:

1. Outline the basic ideas and solve for quantitative problems of the listed topics. Memorize scientific foundations to continue studies in more advanced courses in science and engineering.
2. Recognize lecture material by performing experiments that emphasize fundamental concepts of physics and learn the proper use of equipment and Learn experimental lab techniques.
3. Record of the inherent uncertainties of all measurements and Improve skills in the recording of data and the writing of scientific reports.
4. Reproduce and perform simple data analysis.
5. Develop skills in the recording of data and the writing of scientific reports and understand and perform simple data analysis.
6. Design simple experiments to test hypothesis and solve problems.
7. Show multidisciplinary teamwork skills.
8. Use effective Communication both orally and in writing.

<table>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>-</td><td>Quiz</td><td>-</td><td>Lab</td><td>-</td><td>Project</td><td>-</td></tr>
<tr><td>Midterm</td><td>60%</td><td>Final</td><td>-</td><td>Others (Reports)</td><td>40%</td><td></td><td></td></tr>
<tr><td>Textbook</td><td colspan="8">Physics Laboratory Experiments, 7/E, by Jerry D. Wilson, Lander College, Cecilia A. Hernádez, Houghton Mifflin- Cengage, (2009).</td></tr>
<tr><td>References</td><td colspan="8">University Physics: Principles and Modern Applications, 12/E, by Hugh D. Young and Roger A. Freedman, Addison-Wesley, (2008).</td></tr>
</table>

<table>
<tr><td>Course Name</td><td colspan="4">General Physics 2</td><td colspan="2"></td></tr>
<tr><td>Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td colspan="2">Prerequisite</td></tr>
<tr><td></td><td>Phys 202</td><td>0824202</td><td>3</td><td>3</td><td colspan="2">General Physics 1 (0824101)</td></tr>
<tr><td>Course Track</td><td colspan="6">☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
</table>

Course Description

This course covers the following topics: Electric force and coulomb's law, Electric fields, Gauss's Law and its applications, Electric potential, Capacitance & Dielectrics, Current & Resistance, Direct current circuits, Current density, resistivity and conductivity, Sources of magnetic field and Magnetic fields, Ampere's law, Biot-Savart Law, Faraday's law, Alternating current circuits.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize basic electric and magnetic quantities: charge, electric and magnetic forces, potential, electric and magnetic fields, Capacitance, current, voltage, circuits, electromagnetic waves.
2. Outline Kirchhoff's rules and their applications in circuitry.
3. Explain basic notions and concepts of electricity and magnetism.
4. Identify the electromagnetic induction and its sources.
5. Analyze laws of electricity and magnetism and evaluate related quantities.
6. Explain basic notions and concepts of electricity and magnetism.
7. Illustrate the connection between electric field and electric flux.
8. Demonstrate the interaction of electric field with matter.
9. Demonstrate student's communication working skills.

<table>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>20%</td><td>Lab</td><td>-</td><td rowspan="2">Project</td><td rowspan="2">-</td></tr>
<tr><td>Midterm</td><td>30%</td><td>Final</td><td>40%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="8">Physics for Scientists and Engineers with Modern Physics. Raymond A. Serway and John W. Jewett ,10th Edition. Cengage Learning US (2018).</td></tr>
<tr><td>References</td><td colspan="8">Fundamentals of Physics: David Halliday , R.Resnick; latest edition, John Wiley & Sons Inc., 10th ed., (2013).</td></tr>
</table>

Course Name	General Physics 2 Lab				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 212	0824212	3	1	-
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course covers the following topics: Ohm's law, Wheatstone Bridge, Kirchhoff's Laws, Resistivity, RLC circuit, The Biot-Savart Law, Capacitors in series and in parallel, RC Circuit, The Mechanical Equivalent of Heat, The Galvanometer, and The magnetic moment.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe knowledge of mathematics and science.
2. Recognize the method to conduct experiments, record variables and interpret data.
3. Reproduce and perform simple data analysis.
4. Outline the basic ideas and solve quantitative problems of the listed topics.
5. Develop skills in identifying, formulate, and solve different problems
6. Explain the usage of different tools and apparatus.
7. Show relevant ideas and demonstrate in groups.
8. Use effective Communication both orally and in writing.

Assessment Policy	**Assignment**	-	**Quiz**	-	**Lab**	-	**Project**	-
	Midterm	60%	**Final**	-	**Others (Reports)**	40%		

Textbook	Physics Laboratory Experiments, 7/E, by Jerry D. Wilson, Lander College, Cecilia A. Hernádez, Houghton Mifflin- Cengage, (2009).
References	University Physics: Principles and Modern Applications, 12/E, by Hugh D. Young and Roger A. Freedman, Addison-Wesley, (2008).

Course Name	General Physics 3				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 203	0824203	3	3	-
Course Track	☐University Requirement ☐College Requirement ☒Specialized Core ☐ Electives				

Course Description

This course covers the following topics: mechanical waves and vibrations, wave motion, electromagnetic oscillations, superposition, interference, resonance, Speed of Sound Waves, Sound Waves, Intensity of Sound Waves, Spherical and Plane Waves, the Doppler Effect in sound, heat and thermodynamics laws, Thermal expansion of Solids and Liquids, Macroscopic Description of an Ideal Gas, Some Applications of the First Law of Thermodynamics, Energy Transfer Mechanisms.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define vibrational harmonic motion, wave, wave motion, temperature and heat.
2. Recognize waves sound instruments and to know their properties and uses.
3. Explain basic notions and concepts of vibrational harmonic motions, wave motions, temperature and heat.
4. Illustrate student’s critical thinking about the contents of the course.
5. Demonstrate student's communication working skills

Assessment Policy	**Assignment**	10%	**Quiz**	20%	**Lab**	-	**Project**	-
	Midterm	30%	**Final**	40%	**Others**	-		
Textbook	Physics for Scientists and Engineers with Modern Physics. Raymond A. Serway and John W. Jewett, 10th Edition. Cengage Learning US (2018).							
References	Fundamentals of Physics: David Halliday , R.Resnick; latest edition, John Wiley & Sons , Inc.10th ed., (2013).							

Course Name	General Physics 3 Lab				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 213	0824213	3	1	-
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course covers the following topics: Simple Pendulum, Glass prism refraction, Speed of light, Sonometer, Resonant tube (one open end), Standing waves (Meld's experiment), Seebeck's effect, Young double slit experiment, Diffraction grating, Coefficient of Linear Thermal expansion, specific heat, and Latent heat of ice.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the ideas of the listed topics and record quantitative data.
2. Memorize the proper use of fine equipment.
3. Reproduce the inherent uncertainties of all measurements.
4. Measure and evaluate quantities; summarize results and write scientific reports.
5. Design simple experiments.
6. Demonstrate ability to work in multidisciplinary teams.
7. Show skills to communicate effectively both orally and in writing.

Assessment Policy	**Assignment**	-	**Quiz**	-	**Lab**		**Project**	-
	Midterm	60%	**Final**	-	**Others (Reports)**	40%		

Textbook	Physics Laboratory Experiments, 7/E, by Jerry D. Wilson, Lander College, Cecilia A. Hernádez, Houghton Mifflin-Cengage, (2009).
References	Physics for Scientists and Engineers, 2/E, by Randall D. Knight, Addison-Wesley Pearson, (2008).

Course Name	Mathematical Physics 1				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Phys 201	0824201	3	3	Calculus 1 (0827101)
Course Track	☐ **University Requirement** ☐ **College Requirement** ☒ **Specialized Core** ☐ **Electives**				

Course Description

Sequence and series, Complex numbers &variables , Determinants and matrices ,Vector algebra and operations in Cartesian and curvilinear coordinates, Fourier series, First and second order ordinary differential equations (ODE)

Course Outcomes

1. After the completion of this course, the student will be able to:
2. Describe the mathematics behind the physical phenomena and knowledge of mathematical techniques needed in solving physical problems, and how to apply them to some branches of physics.
3. Recognize mathematical techniques needed in solving physical problems and how to apply them to some branches of physics. Get acquainted with the mathematical method used mainly in classical mechanics, electromagnetism, heat transfer and quantum mechanics.
4. Develop problem-solving skills with applications of mathematical technique introduced in the course.
5. Use mathematical methods used mainly in classical mechanics, electromagnetism, heat transfer and quantum mechanics.
6. Demonstrate sane scientific language.
7. Appraise the student's self-dependency concerning collecting materials related to the subject of the course.
8. Demonstrate competence to make good and clear scientific discussions with the lecturer and his classmates about the different concepts introduced in the course.
9. Evaluate the performance when performing numerical calculations (solving problems, data analysis, physical meaning of the numerical results) dealing with the contents of the course.

Assessment Policy	**Assignment**	10%	**Quiz**	20%	**Lab**		**Project**	
	Midterms	30%	**Final**	40%	**Others**			
Textbook	Mathematical methods for Physicists: George B. Arfken, 6th Ed.							
References	Mary L. Boas, Mathematical Methods in Physical Sciences, 3rd edition, John Wiley & Sons, 2006.							

Course Name	Waves				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hours**	**Prerequisite**
	Phys 204	0824204	4	3	Mathematical physics 1 (0824201)
Course Track	☐University Requirement ☐ College Requirement ☒Specialized Core☐ Electives				

Course Description

Periodic Phenomena, simple harmonic motion, Longitudinal (sound) and Transverse (string under tension) mechanical Waves, Transverse Electromagnetic Waves, Complex Numbers and Phasor Technique, energy, superposition, Free, Damped, and Forced Mechanical Oscillations, quality factor Q, power at resonance, transient phenomena, coupled oscillators, traveling waves , standing waves, Applications of Fourier analysis , Doppler effect to sound waves.

Course Outcomes

After the completion of this course, the student will be able to:

1. Define various system of oscillation and their normal and resonance modes.
2. Describe the physics of the waves.
3. Memorize the principles of : Oscillation, superposition, Doppler effect, resonance.
4. Develop strong problem-solving strategies and self-study skills.
5. Interpret the everyday life wave phenomena.
6. Use student's communication and independent working skills to help him be team player.
7. Develop students' communication working skills and working in groups.

Assessment Policy	**Assignment**	10 %	**Quiz**	20%	**Lab**	-	**Project**	-
	Midterm	30%	**Final**	40%	**Others**	-		
Textbook	The Physics of Vibrations and Waves, H. J. Pain Pain, 6th Edition, Wiley (2005).							
References	Vibrations and Waves - by: Iain G. Main– Cambridge University Press -1998							

<table>
<tr><td>Course Name</td><td colspan="3">Modern Physics</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td colspan="2">Course Level</td><td colspan="2">Credit Hour</td><td colspan="2">Prerequisite</td></tr>
<tr><td>Phys 205</td><td>0824205</td><td colspan="2">4</td><td colspan="2">3</td><td colspan="2">General Physics 3 (0824203)</td></tr>
<tr><td>Course Track</td><td colspan="8">☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="9">Course Description
Modern physics covers the following topics: Inertial frame of reference and Galilean transformation, Michelson Morley experiment, Einstein postulates of special relativity, Time dilation, Length contraction, Relativity of mass and linear momentum, Lorentz transformation, Mass and Energy, Massless Particles (photon) and Velocity addition. Doppler Effect in Light. Black body radiation, Steven Boltzmann law, Kirchhoff's law, classical interpretations, modern interpretation and Planck's law, Photoelectric effect, Compton Effect and Pair production. Particle Behavior of Light, Wave Behavior of Particles, De Broglie theory for the wave-particle duality, probability density, wave packets, the Davisson Germer Experiment, particle in a box problem and uncertainty Heisenberg principle. Pre-Quantum Classical and Semi-Classical Atomic Models: Thomson's model, Rutherford's Model, Bohr's Model and relation between Energy levels and spectra. X-ray production, continuous x-rays, Characteristics x-rays, Efficiency of tube production, absorption of X-ray, diffraction of x-rays in crystals and Bragg’s law, quantum Mechanical Theory (principles of quantum mechanics).</td></tr>
<tr><td colspan="9">Course Outcomes
After the completion of this course, the student will be able to:
1. Define the postulates of special relativity and its consequences and applications.
2. Describe the duality wave-particle nature of matter and its applications in physics.
3. Define the different atomic models that led to a deep insight of the structure of the atom.
4. Analyze problems on the different topics of the course
5. Reorganize the different applications that are based on the ideas of modern physics (Relativity theory and Quantum Mechanics).
6. Demonstrate the comprehensive analysis of problems and ideas.
7. Show Self dependence concerning collecting of materials that are related to the subject of the course.
8. Operate effectively in a group.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Homework</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>-</td><td rowspan="2">Project</td><td rowspan="2">10%</td></tr>
<tr><td>Midterm</td><td>30%</td><td>Final</td><td>40%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="8">Concepts of Modern Physics: 6^{th} Edition, by Arthur Beiser McGraw-Hill, Inc.(2003).</td></tr>
<tr><td>References</td><td colspan="8">Special relativity, A.P. French, M.I.T. Introductory Phys. Series, Van Nostrand Reinhold ltd (1986).</td></tr>
</table>

Course Name	Optics				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 206	0824206	4	3	General Physics 3, (0824203)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course covered the following topics Geometrical Optics and Image formation by optical systems, Wave's theory of light, Interference, Wavefront splitting interferometer, Amplitude splitting interferometer , Fabry-Perot interferometer , Matrix algebra in optics, Diffraction and Polarization

Course Outcomes

After the completion of this course, the student will be able to:

1. Define the basics concepts and principles of Optics.
2. Reproduce the laws of thin and thick Lenses and images formation.
3. Describe the polarization, interference and diffraction of light.
4. Analyse problems with applications of mathematical techniques.
5. Reconstruct in the everyday life optic phenomena.
6. Use mathematical formulation.
7. Operate group discussion of the HW problems.

Assessment Policy	Homework	10%	Quiz	20%	Lab		Project	
	Midterm	30%	Final	40%	Others			

Textbook	Introduction to Optics, by Frank J. Pedrotti, Leno M, Leno S. Pedrotti, 3rd edition, Benjamin Cummings (2006).
References	Halliday, David, Robert Resnick, Jearl Walker. Fundamentals of Physics, 7th edition, Hoboken, N.J.: John Wiley and Sons. 2005.

Course Name	Classical Mechanics				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Phys 302	0824302	5	3	Mathematical Physics 1, (0824201)
Course Track	☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course covers the following topics: Newtonian's, Lagrangian's and Hamilton's Formulation, Variational principle, The Central Force and gravitational Problem, Canonical Transformation, dynamics of rigid body (Center of mass and moment of inertia of rigid bodies), Rutherford Scattering.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the basic concepts and methods of mechanics and describe how to apply them to simple physical systems.
2. Use mathematical formulation to describe the physical principle or phenomena.
3. Recognize calculations using Newton's law in one, two and three dimensions.
4. Analyze problems with applications of mathematical technique introduced in the course.
5. Explain applications of mechanics.
6. Illustrate student's critical thinking about the contents of the course.
7. Use scientific language and analyze problems and ideas.
8. Work in groups**.**

Assessment Policy	**Homework**	10%	**Quiz**	10%	**Lab**	-	**Project**	**10%**
	Midterms	30%	**Final**	40%	**Others**	-		

Textbook	Analytical Mechanics: by G. L. Cassiday, G. R. Fowles, 7th edition, Cengage Learning (2004).
References	Classical dynamics of Particles and Systems by: Jerry B.Marion 5th edition

Course Name	Modern Physics Lab				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 411	0824411	7	2	Modern Physics (0824205), Quantum Mechanics 1 (0824307)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

Modern Physics Lab course is a laboratory-based course, which allows students to experimentally reproduce and deepen their understanding of many important subjects in the areas of modern physics such as wave-particle duality, interaction of light with matter, radiation detection, atomic spectra and quantum phenomena.

Course Outcome

After the completion of this course, the student will be able to:

1. Reproduce experiments in the important areas of modern physics, i.e. wave-particle duality, interaction of light with matter, radiation detection, atomic spectra and quantum phenomena.
2. Recall the theoretical bases of the topics related to the experiments, e.g. radiation detection, photoelectric effect, atomic models, Zeeman effect, and electron spin resonance.
3. Analyze and interpret the results of laboratory measurements, using equations and graphs.
4. Summarize the theoretical bases of an experiment and compare the practical findings with the literature values.
5. Demonstrate the comprehensive analysis of problems and ideas.
6. Demonstrate work independently and as a part of team on a specific task.
7. Employ computer software and Internet for processing, collecting information and analysing the experimental data.

Assessment Policy	**Homework**	-	**Quiz**	-	**Lab**		**Project**	-
	Midterm	30%	**Final**	30%	**Others (Reports)**	40%		
Textbook	General Catalogue of Physics experiments of LEYBOLD Company (Atomic and Nuclear Physics section); www.ld-didactic.de							
References	H. Mark and N. Olson, Experiments in Modern Physics.							

<table>
<tr><td>Course Name</td><td colspan="3">Mathematical Physics 2</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite</td></tr>
<tr><td>Phys 301</td><td>0824301</td><td>6</td><td>3</td><td>Mathematical physics 1, 0824201</td></tr>
<tr><td>Course Track</td><td colspan="5">☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
</table>

Course Description

The course covers the following topics: Complex analysis, Partial differential equations, Dirac delta function Gamma function and Beta function , Fourier Transforms and Laplace transforms, Legendre polynomials, Legendre functions and spherical harmonics, Ordinary and modified Cylindrical and Spherical Bessel's functions. Sturm-Liouville eigenvalue problem.

Course Outcomes

After the completion of this course, the student will be able to:

1. State thinking about the mathematics behind the physical phenomena.
2. Recognize method of separation of variables and apply it to solve PDE in various systems of coordinates.
3. Write the initial and boundary conditions correctly to some physical problems.
4. Prepare many problems with solving Mathematical physics.
5. Use comprehensive analysis and ideas.
6. Develop itself to solve problems with applications of mathematical technique introduced in the course.
7. Appraise exchanging ideas on lecture between students.
8. Search properly on the internet about topics of the course.

<table>
<tr><td rowspan="2">Assessment Policy</td><td>Homework</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>-</td><td>Project</td><td rowspan="2">10%</td></tr>
<tr><td>Midterm</td><td>30%</td><td>Final</td><td>40%</td><td>Other</td><td>-</td><td></td></tr>
<tr><td>Textbook</td><td colspan="8">Mathematical methods for Physicists: George B. Arfken, 4th Ed.</td></tr>
<tr><td>References</td><td colspan="8">Mathematical Methods for Physicists and Engineering: K. F. Riely, M. P. Hobson; Cambridge Univ.</td></tr>
</table>

Course Name	Electromagnetism 2				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Phys 304	0824304	6	3	Electromagnetism 1, (0824303)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course covers the following topics: magnetic properties of matter, electromagnetic induction, magnetic energy, Maxwell's equations, propagation of electromagnetic waves, Pointing's theorem and electromagnetic energy, reflection of electromagnetic waves from planar dielectric and conducting boundaries, electromagnetic cylindrical resonance cavity, ideal rectangular and circular waveguides.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the basic concepts and methods of electromagnetic theory with concentration on magneto statics and Maxwell's equations, describe how to apply them to simple physical systems.
2. Use mathematical formulation to describe the physical principle or phenomena.
3. Recognize calculations using Maxwell's equations to derive the wave equation and conservation of energy.
4. Analyze problems with applications of mathematical technique introduced in the course.
5. Explain applications of Maxwell's equations.
6. Use scientific language and analyze problems and ideas.
7. Ability to work in a group to discuss the homework problems and its meanings and goals.
8. Competence to make good and clear scientific discussions with the lecturer and his class mates about the different concepts of electromagnetic physics.

Assessment Policy	**Homework**	10%	**Quiz**	10%	**Lab**	-	**Project**	10%
	Midterms	30%	**Final**	40%	**Others**	-		

Textbook	Foundations of Electromagnetic Theory: by J. R. Reitz, F. J. Milford, 4th edition Addison-Wesley (2008).
References	Introduction to electrodynamics: by David J. Griffiths, 4th edition, (2017).

<table>
<tr><td>Course Name</td><td colspan="3">Electronics 2</td><td colspan="6"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td colspan="2">Course Level</td><td colspan="2">Credit Hour</td><td colspan="3">Prerequisite</td></tr>
<tr><td>Phys 306</td><td>0824306</td><td colspan="2">6</td><td colspan="2">3</td><td colspan="3">Electronics 1, 0824305</td></tr>
<tr><td>Course Track</td><td colspan="9">☐University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="10">Course Description

The course covers the following topics: introduction to Semiconductors, Diode Theory and Diode Circuits, Diodes Bipolar Transistors, Transistor Biasing AC Models, Field-Effect Transistors FET Circuits, OP-AMP Theory, Oscillators, Comparators, Regulated Power Supplies, Digital Electronics, Binary Arithmetic, Digital Logic and Gates, Flip-Flops and Memories Digital Counters, Shift Registers.</td></tr>
<tr><td colspan="10">Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the Fundamentals of modern electronics.
2. Describe and recognize circuit components and combination concepts.
3. Outline and recognize how to solve problems and to reproduce the analysis of results correctly.
4. Create a baseline to solve problems efficiently using different approaches.
5. Develop the ability to tackle practical problems in electronic circuits.
6. Use scientific language and write down comprehensive analysis of problems and ideas.
7. Develop his writing and speaking as a means of good scientific communication.
8. Competence to make good and clear scientific discussions with the lecturer and classmates about the different concepts of electronics.</td></tr>
<tr><td>Assessment Policy</td><td>Homework</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>-</td><td>Project</td><td rowspan="2" colspan="2">10%</td></tr>
<tr><td></td><td>Midterm</td><td>30%</td><td>Final</td><td>40%</td><td>Others</td><td>-</td><td></td></tr>
<tr><td>Textbook</td><td colspan="9">Basic Electronics: An Introduction to Electronics for Science Students, By Curtis A. Meyer, 2nd Edition, Curtis A. Meyer, (2010).</td></tr>
<tr><td>References</td><td colspan="9">Electronic Principles / Edition 7 by Albert Paul Malvino, David J. Bates, (2006).</td></tr>
</table>

Course Name	Electronics 2 lab				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 316	0824316	6	2	Electronics 1, (0824305)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course covers the following topics: Diode characteristics, Half wave rectification, Full bridge rectification, Bipolar transistor IV characteristics, CMOS transistor IV characteristics, Common source circuit, Common base circuit, Common emitter circuit, Op-Amps Inverting non inverting, Discreet Logic Gates, Electronic simulators.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the basic concepts and methods of practical analog and digital electronics.
2. Recall circuit concepts and description in addition to have the ability to connect circuits and debug them.
3. Recognize different types of transistors and basic building devices in electronics.
4. Develop the ability to design practical solutions in electronic circuits.
5. Use scientific language and analyze technical problems and ideas.
6. To show self-dependence concerning collecting materials and data sheets related to the subject of the lab experiments.
7. Evaluate the experimental data, by performing best fitting with data drawing and fitting programs and write reports.
8. Promote team-work and self-dependence concerning collecting materials related to the subject of the course.

Assessment Policy	**Assignment**	-	**Quiz**	-	**Lab**	-	**Project**	-
	Midterm	30%	**Final**	30%	**Others reports**	40%		

Textbook	Principles of Electronics: Analog and Digital, 1^{st} Edition, Lloyd Fortney, Oxford University Press (2006).
References	Electronic principles: Malvino, Albert Paul, 5^{th} ed., Macmillan Publishing Company (1994).

Course Name	Quantum Mechanics 1				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 307	0824307	6	3	Mathematical Physics 2 (0824301)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course covers the following topics: Basic concepts, Postulates of quantum mechanics, Wave function, Schrödinger equation, The simple harmonic oscillator and Orbital angular momentum.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the connection between basic concept, formalism and postulates of quantum mechanics.
2. Memorize the laws of: the wave function, the probability density of current and expectation values of observables.
3. Reproduce solutions of Schrödinger's equation for a variety of problems.
4.Write operator algebra: Creation and annihilation operators for the harmonic oscillator.
5. Explain the basic notions and concepts of Quantum Mechanics.
6. Prepare many problems with solving in Quantum Mechanics.
7. Use comprehensive analysis and choose solving problems related to the subject of the course
8. Work in a group to discuss the homework problems and its meanings and goals.

Assessment Policy	**Homework**	10%	**Quiz**	10%	**Lab**	-	**Project**	10%
	Midterm	30%	**Final**	40%	**Other**	-		

Textbook	David J. Griffiths, " Introduction to Quantum Mechanics", 2nd Ed. Cambridge University Press (2016).
References	Quantum Mechanics Concepts and Applications Second Edition (Nouredine Zettili); 2nd Ed, Jacksonville State University, Jacksonville, USA, (2009).

Course Name	Thermal and statistical physics				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 401	0824401	7	3	General Physics 3 (0824203) and Quantum Mechanics 1 (0824307)
Course Track	☐University Requirement ☐College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This This course covers the following topics: Thermodynamic concepts. The zero and first law of thermodynamics, heat capacities, classification of thermodynamic processes. The second law of thermodynamics, thermodynamic temperature scales, heat engines, third law of thermodynamics, Equilibrium conditions and thermodynamic potentials (thermodynamic potentials/derivatives basics of probability, binomial distribution, continuous probability distribution, central limit theorem, random walk)", thermodynamics of magnetism, paramagnetism, many particle systems, equipartition theorem, Partition function and its relation to entropy and to various thermodynamic potentials. Equilibrium classical and quantum distributions: Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac, Bose and Fermi gases, density of states, blackbody radiation, bose condensation, Debye theory of elastic vibrations in solids, phase equilibria, clausius-clapeyron equation.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recall basic probability and statistical concepts, theories and applications and Outline basic thermodynamic quantities
2. Recall of counting states and many particle system Tell the Lattice Dynamics process and the Thermal properties of solid materials
3. Recognizing of chemical potential and phase equilibrium and explaining the simulation methods using some available simulation software in internet and related webs.
4. Describe general relationships among macroscopic variables such as energy, volume, temperature and pressure
5. Recognize the concepts of heat and its transformations, and interpret the laws of thermodynamics.
6. Develop the skills in solving problems and summarize the mechanisms and procedures to handle problems.
7. Use scientific language and analyze problems and ideas.
8. Operate in a group to discuss the homework problems and its meanings and goals.

Assessment Policy	**Homework**	10%	**Quiz**	10%	**Lab**	-	**Project**	10%
	Midterm	30%	**Final**	40%	**Others**	-		
Textbook	An Introduction to Thermal Physics, by Daniel V. Schroeder (Addison Wesley, (2000).							
References	Thermal and Statistical Physics Lecture Notes, by H. Gould and J. Tobchnik.							

<table>
<tr><td>Course Name</td><td colspan="4">Solid State 1</td><td></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite</td></tr>
<tr><td>Phys 402</td><td>0824402</td><td>7</td><td>3</td><td>Quantum mechanics 1, (0824307)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐University Requirement ☐College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="6">Course Description
This course covers the following topics: Crystallography and Crystal Structure, Wave Diffraction, Reciprocal Lattice, Binding forces and classification of solids, Lattice dynamics, Thermal Properties of Solids, Free Electrons in Metals.</td></tr>
<tr><td colspan="6">Course Outcomes
After the completion of this course, the student will be able to:
1. Memorize the fundamental Theories of Solid State Physics and define the Crystal Structure and crystal binding types.
2. Describe the phenomena of Crystal Diffraction and experimental techniques of crystal diffraction, X-Ray diffraction.
3. Tell the Lattice Dynamics process and the Thermal properties of solid materials
4. Compare the theoretical results with experimental data.
5. Explain the simulation methods using some available simulation software in internet and related webs.
6. Working in groups to analyze problems or to search an information in the web
7. Illustrate students' skills in using technology platforms in classroom and online resources.
8. Improve student’s confidence in solving problems introduced in the course.</td></tr>
</table>

<table>
<tr><td rowspan="2">Assessment Policy</td><td>Homework</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>-</td><td rowspan="2">Project</td><td rowspan="2">10%</td></tr>
<tr><td>Midterm</td><td>30%</td><td>Final</td><td>40%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="8">C. Kittel: Introduction to Solid State Physics, 8th Edition, Wiley,(2012),</td></tr>
<tr><td>References</td><td colspan="8">F. Han, Problems in solid state physics with solutions. (World Scientific, Singapore, Hackensack, NJ, (2012).</td></tr>
</table>

<table>
<tr><td>Course Name</td><td colspan="3">Quantum Mechanics 2</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite(s)</td></tr>
<tr><td>Phys 407</td><td>0824407</td><td>7</td><td>3</td><td>Quantum Mechanics 1, (0824307)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐University Requirement ☐College Requirement ☒ Specialized Core ☐ Electives</td></tr>
</table>

Course Description

Topics covered in this course are General Theory of the Angular Momentum: Commutation relations, matrix representation. Radial and angular parts of time-independent Schrödinger's equation, spherical harmonics. Application of time- independent Schrödinger's equation to ideal hydrogen atom, Central potential, Addition of Angular Momentum Total angular momentum and spin, Identical particles, Scattering theory. First order time-independent perturbation theory.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the basic concepts and methods of quantum mechanics and to apply them from simple to complex physical systems.
2. Outline mathematical formulation to describe the physical principle or phenomena.
3. Solve problems with applications of mathematical technique introduced in the course.
4. Construct mathematical proofs and derivations of key physics laws and apply them to particular context.
5. Demonstrate sane scientific language.
6. Demonstrate comprehensive analysis of problems and ideas.
7. Ability to work in a group to discuss the homework problems and its meanings and goals.
8. Competence to make good and clear scientific discussions with the lecturer and his class mates about the different concepts of quantum physics.
9. Evaluate the importance of Scattering theory for solving the problem of particles interaction on atomic scale.

<table>
<tr><td rowspan="2">Assessment Policy</td><td>Homework</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>-</td><td rowspan="2">Project</td><td rowspan="2">10%</td></tr>
<tr><td>Midterms</td><td>30%</td><td>Final</td><td>40%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="8">Nouredine Zettili, “Quantum Mechanics Concepts and Applications", 2nd Ed., Wiley (2009).</td></tr>
<tr><td>References</td><td colspan="8">Walter Greiner, Quantum Mechanics.</td></tr>
</table>

Course Name	Solid State 2				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 403	0824403	8	3	Solid State 1 (0824402)
Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives				

Course Description

This course covers the following topics: Free electron fermi gas, Energy bands, Semiconductor crystals, Fermi surfaces and metals, Superconductivity, Magnetism in solids.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the Semiconductor materials and metals.
2. Define Fermi surface, Energy bands, and Superconductivity.
3. Outline the basic principles in Superconductivity and Magnetism in solids.
4. Explain problems related to different topics covered in the course.
5. Prepare solutions to different problems using mathematical and scientific methods.
6. Demonstrate the free electron fermi gas theory.
7. Analyze the physical conditions for superconductivity phenomenon.
8. Use different simulation models to solve problems related to the Material.

Assessment Policy	**Assignment**	10%	**Quiz**	10%	**Lab**	**-**	**Project**	**10%**
	Midterm	30%	**Final**	40%	**Others**	**-**		

Textbook	C. Kittel: Introduction to Solid State Physics, 8th Edition ,Wiley, (2012).
References	F. Han, Problems in solid state physics with solutions, World Scientific, Singapore; Hackensack, NJ, (2012).

<table>
<tr><td>Course Name</td><td colspan="3">Introduction to spectroscopy analysis</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hours</td><td>Prerequisite</td></tr>
<tr><td>Phys 423</td><td>0824423</td><td>8</td><td>3</td><td>Mathematical physics 2 (0824301), Quantum physics 1 (0824307)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives</td></tr>
</table>

Course Description

This course is an attempt to introduce students to the spectroscopic measurements and analysis using a variety of modern techniques. It allows students to get acquainted with the physical concepts and theoretical treatments of a wide range of different spectroscopic techniques including Raman spectroscopy, infrared spectroscopy, ultraviolet and x-ray spectroscopy, Laser Spectroscopy and nuclear magnetic resonance spectroscopy.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe the course subjects' principles and concepts.
2. Recognize and outline all the spectroscopic techniques listed above.
3. Analyze physics problems in easy, logical and organized steps.
4. Analyze and interpret quantitative results.
5. Develop skills for solving problems.
6. Demonstrate effective work in small groups.
7. Demonstrate ability to collect and refine course material.
8. Demonstrate effective use of modern technology and communications skills and tools.

<table>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>-</td><td rowspan="2">Project</td><td rowspan="2">10%</td></tr>
<tr><td>Midterm</td><td>30%</td><td>Final</td><td>40%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="8">Kuzmany, H: Solid State Spectroscopy: An Introduction, 2nd edition, Springer-Verlag Berlin Heidelberg (2009).</td></tr>
<tr><td>References</td><td colspan="8">Gauglitz, G. & Vo-Dinh, T: Handbook of Spectroscopy</td></tr>
</table>

Course Name	Photonics and Fiber Optics				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hours**	**Prerequisite**
	Phys 422	0824422	8	3	Mathematical physics 2 (0824301), Electromagnetism 1 (0824303)
Course Track	☐University Requirement ☐ College Requirement ☐ Specialized Core☒ Electives				

Course Description

This course covers the following subjects: ray, wave, beam and Fourier optics, fundamentals of fiber-optic components, basics of communications, properties of optical fibers, structure and manufacturing of their materials, light sources, fiber-optic measurements, trouble shouting and test equipment, global telecommunications, internet, video, mobile, sensing, imaging and illuminating applications of fiber-optics.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe the course subjects' principles and concepts
2. Recognize and outline the basic photonics principles and fiber optics applications
3. Analyze physics problems in easy, logical and organized steps.
4. Analyze and interpret quantitative results.
5. Develop skills for solving problems
6. Demonstrate effective work in small groups.
7. Demonstrate ability to collect and refine course material.
8. Demonstrate effective use of modern technology and communication skills and tools.

Assessment Policy	**Assignment**	10%	**Quiz**	10%	**Lab**	-	**Project**	10%
	Midterm	30%	**Final**	40%	**Others**	-		

Textbook	Saleh, B. E. A. & Teich, M. C: Fundamentals of Photonics, 2nd Edition, Wiley (2007).
References	Hecht, J: Understanding Fiber Optics.

Course Name	Materials Science and Nanotechnology				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite(s)**
	Phys 420	0824420	8	3	Quantum Mechanics 1 (0824307) and Solid State1 (0824402)
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

This course covers the following subjects: Atomic Structure and Interatomic Bonding, Crystal structures and miller planes, defects, diffusion, stress and strain, understanding of physics related to nanomaterials, zero-, one-, two-dimensional nanostructures, energy bands in solids (metal, semiconductor and insulators), energy levels in nanostructures, surface-energy and –reconfiguration, nanoparticles nucleation, use of electron microscopy, X-ray diffraction, optical spectroscopy for nanomaterials characterization, top-down and bottom up synthesis methods of nanostructures; Chemical vapor deposition, electrodeposition, Sol-gel, Sputtering, devices fabrication by using Nanomaterials; Single electron transistor, carbon nanotube field effect transistor (FET), Spin-FET

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the basic materials science and nanotechnology concepts, theories and applications.
2. Define general relationships among 1D, 2D and 0D nanomaterials and their electronic states.
3. Outline basic electronic and magnetic properties of nanomaterials.
4. Explain concepts of material science and nanotechnology and apply them in the rapidly growing field of nanomaterials devices.
5. Develop problem - solving skills.
6. Demonstrate working in groups to solve problems or to search for information in the web.
7. Demonstrate students skills on group working.

Assessment Policy	**Assignment**	10%	**Quiz**	10%	**Lab**	-	**Project**	10%
	Midterms	30%	**Final**	40%	**Others**	-		

Textbook	Fundamentals and Applications of Nanomaterials by Zhen Guo and Li Tan 1st Edition, Artech House (2009).
References	Science direct , Organic electronics, Applied physics latter

<table>
<tr><td>Course Name</td><td colspan="3">Medical Physics</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite</td></tr>
<tr><td>Phys 424</td><td>0824424</td><td>8</td><td>3</td><td>Modern Physics 0824205</td></tr>
<tr><td>Course Track</td><td colspan="5">☐University Requirement ☐College Requirement ☐Specialized Core ☒ Electives</td></tr>
</table>

Course Description

This course covers the following Topics: imaging metrics, ionizing radiation and radiation safety, radioactivity, radiation therapy, computed tomography, nuclear medicine, ultrasound, and magnetic resonance imaging.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe imaging system and break it down into its components.
2. Recognize the imaging principles for each of the imaging modalities (techniques) X-ray imaging, Ultrasound imaging, Radiation exposure principles and Nuclear magnetic resonance.
3. Tell the key factors that affect image quality for the different imaging techniques.
4. Compare between the imaging principles for each of the imaging modalities (techniques) X-ray imaging, Ultrasound imaging, Radiation exposure principles and Nuclear magnetic resonance.
5. Analyze factors that affect image quality for the different imaging techniques.
6. Demonstrate research and communication skills.
7. Analyze the effect of radiations in diagnosis and therapy.
8. Evaluate the role of mechanics in medicine.
9. Illustrate some applications of lasers in medicine.
10. Research in medical physics concepts and nuclear medicine physics.
11. Calculate the doses accepted from radiation source at different distances from it.

<table>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>-</td><td rowspan="2">Project</td><td rowspan="2">10%</td></tr>
<tr><td>Midterm</td><td>30 %</td><td>Final</td><td>40%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="8">Medical Imaging Physics, by W.R. Hendee and E.R. Ritenour, Wiley-Liss; 4th edition (2002).</td></tr>
<tr><td>References</td><td colspan="8">Medical Imaging Physics, by W.R. Hendee and E.R. Ritenour.</td></tr>
</table>

<table>
<tr><td>Course Name</td><td colspan="3">Plasma Physics</td><td colspan="6"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td colspan="5">Prerequisite(s)</td></tr>
<tr><td>Phys 427</td><td>0824427</td><td>8</td><td>3</td><td colspan="5">Electromagnetism 2 (0824304), Classical mechanics (0284302), Mathematical physics 2 (0824301)</td></tr>
<tr><td>Course Track</td><td colspan="9">☐University Requirement ☐College Requirement ☐Specialized Core ☒ Electives</td></tr>
<tr><td colspan="10">Course Description
In this course students will learn: definition of plasma. Applications in physics and technology. Debye screening. Single-particle motions in electromagnetic fields and adiabatic invariants. Fluid models of plasmas. Waves in plasmas. Wave propagation, group velocity, cut-off and resonance. Collisions, resistivity and diffusion. Equilibrium and plasma instabilities.</td></tr>
<tr><td colspan="10">Course Outcomes
After the completion of this course, the student will be able to:
1. Recognize the basic concepts and methods of plasma physics and describe how to apply them to simple physical systems.
2. Use mathematical formulation to describe the physical principle or phenomena.
3. Recognize calculations using fluid theory and kinetic theory laws to solve problems in plasmas.
4. Analyze problems with applications of mathematical technique introduced in the course.
5. Explain applications of plasmas.
6. Use scientific language and analyze problems and ideas.
7. Ability to work in a group to discuss the homework problems and its meanings and goals.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>-</td><td rowspan="2">Project</td><td rowspan="2" colspan="2">10%</td></tr>
<tr><td>Midterms</td><td>30%</td><td>Final</td><td>40%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="9">Introduction to Plasma physics and controlled fusion: by F. F. Chen, 3rd edition Springer (2016).</td></tr>
<tr><td>References</td><td colspan="9">Fundamentals of plasma physics: by J. A. Bittencourt, 4th edition</td></tr>
</table>

Course Name	Atomic Physics				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 428	0824428	8	3	Modern Physics (0824205), Quantum Mechanics 1 (0824307)
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

The course covers the following topics: atomic phenomena (light emission and x-rays absorption), Atomic models and correspondence principle, Spectra of one valence atoms like hydrogen and sodium - Spectra of hydrogen- like atoms, Quantum numbers and quantum defects, Orbital and spin moments, Effect of external magnetic field on the atomic spectra (Zeeman Effect), Spectra of double electron atoms, Vector model of the atomic structure.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe the concept of cross section related to Rutherford scattering model.
2. State the application of quantum theory to explain the atomic spectra.
3. Write and apply mathematical formulation to the physical principles or phenomena.
4. Analyze problems with applications of mathematical technique introduced in the course.
5. Interpret different atomic spectra of atoms.
6. Demonstrate comprehensive analysis of problems and ideas.
7. Operate in a group to discuss the homework problems and its meanings and objectives.

Assessment Policy	**Assignment**	10%	**Quiz**	10%	**Lab**	-	**Project**	**10%**
	Midterm	30%	**Final**	40%	**Others**	-		

Textbook	H. Haken, H. C. Wolf, The Physics of Atoms and Quanta, 7th edition, Springer (2005).
References	T. A. Littlefield, N. Thorley, Atomic and Nuclear Physics: An Introduction, Springer Science + Business Media, LLC, (1979)

Course Name	Computational Physics				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 431	0824431	8	3	Introduction to computer Sciences (0827102), Introduction to computer Sciences Lab. (0827112), Mathematical Physics 1 (0824201)
Course Track	University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

This course covers the following topics: programming with suitable Package (Mathematica and FORTRAN) and suitable software for plotting scientific data (Origin, etc). learning the most traditional applied built-in functions for transformation of algebraic formulas, numerical calculation (differentiation- integration), solving algebraic equation, Solving differential equations, numerical data manipulation, writing User defined functions and subroutines, data plotting and processing, basic principles and concepts of Monte Carlo simulation, Performing Monte Carlo simulation of some physics Experiments and phenomena: Nuclear decay, Simulation of Thermodynamic Systems, Random Walk and Brownian Motion, Electrostatics, Waves, Diffusion and heat conduction, Nonlinear Systems, Simple Quantum Systems.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize features of MATHEMATICA package and FORTRAN language.
2. Recognize plotting data based on scientific basis for avoiding unacceptable errors.
3. Recall the correct names and functions of Mathematica package and writing the FORTRAN programs, which facilitate the physical problems processing.
4. Constructing simulation programs based on the accepted experience of programming.
5. Analyzing real experimental data
6. Summarize and describe the algorithm used for simulation, and knowing that, there are different algorithms for the same physical entity leading to the same result.
7. Analyzing some physical experiments and phenomena and preparing, them for simulation based on Mote Carlo technique.
8. Performing processing the experimental data with computer programs and applying the computational and statistical tools.

	Assignment	10%	**Quiz**	10%	**Lab**	**-**	**Project**	10%

Assessment Policy	**Midterm**	30%	**Final**	40%	**Others**	**-**		
Textbook	Ian D. Chivers and Jane Sleightholme, Introduction to programming with FORTRAN with coverage of Fortran 90, 95, 2003, 2008 and 77, 2nd Ed., springer (2012).							
References	Ian D. Chivers and Jane Sleightholme, Introduction to programming with FORTRAN with coverage of Fortran 90, 95, 2003, 2008 and 77, 2nd Ed., springer (2012).							

Course Name	Computational Physics Lab				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 432	0824432	8	1	Introduction to computer Sciences (0827102), Introduction to computer Sciences lab (0827112) Mathematical Physics 1 (0824201)
Course Track	☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

This course covers the following topics: computer programming with suitable Package (Mathematica and FORTRAN), plotting scientific data with suitable software (Origin, …etc). Test the most traditional applied built-in functions especially for Mathematica Package. Practicing some simple examples for simulation programs based on Monte Carlo technique. Writing and testing self-written simulation programs for many physics phenomena.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize features of MATHEMATICA package and FORTRAN language.
2. Recognize plotting data based on scientific basis for avoiding unacceptable errors.
3. Recall the correct names and functions of Mathematica package and writing the FORTRAN programs, which facilitate the physical problems processing.
4. Constructing simulation programs based on the accepted experience of programming.
5. Analyzing real experimental data
6. Summarize and describe the algorithm used for simulation, and knowing that, there are different algorithms for the same physical entity leading to the same result.
7. Analyzing some physical experiments and phenomena and preparing, them for simulation based on Mote Carlo technique.
8. Performing processing the experimental data with computer programs and applying the computational and statistical tools.

Assessment Policy	**Assignment**	-	**Quiz**	-	**Lab**	-	Project	-
	Midterm	30%	**Final**	30%	**Others (Reports)**	40%		
Textbook	Timothy Sauer, Numerical Analysis, 2nd Edition, Pearson Education Inc. (2012).							

References	Ian D. Chivers and Jane Sleightholme, Introduction to programming with FORTRAN with coverage of Fortran 90, 95, 2003, 2008 and 77, 2nd Ed., springer (2012).

Course Name	Astronomy				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 426	0824426	8	3	General Physics 1 0824101
Course Track	University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives				

Course Description

This course covers the following topics: a historical introduction to astronomy, Celestial sphere, Motion of the sun and the solar system, Time and calendars, Eclipses, Telescopes, Planetary motion and astronomy beyond the solar system.

Course Outcomes

After the completion of this course, the student will be able to:

1. Recognize the history of astronomy and recognize the millstone historical events, which were the basic keys of its development.
2. Describe the planetary motion using Newton laws.
3. Recognize the celestial sphere concept and its component3
4. Recognize the time calendars for the human life.
5. Recognize astronomical problems related to the solar system.

Assessment Policy	**Assignment**	10%	**Quiz**	10%	**Lab**	-	**Project**	10%
	Midterm	30%	**Final**	40%	**Others**	-		
Textbook	The Cosmic Perspective: 3rd Edition, Jeffrey Bennett; Addison Wesley, (2001).							
References	Introductory to Astronomy: Rich Shaffer, (1999)							

<table>
<tr><td>Course Name</td><td colspan="3">Laser</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td>Prerequisite</td></tr>
<tr><td>Phys 425</td><td>0824425</td><td>8</td><td>3</td><td>Electromagnetism 2 (0824304), Optics (0824203)</td></tr>
<tr><td>Course Track</td><td colspan="5">☐University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives</td></tr>
</table>

Course Description

Students will be exposed to the theory of lasers and basic concepts, transition probabilities, Einstein relations , population inversion, multi-level system, rate equations, laser resonators , Gaussian beam, laser modes ,Q-switching , mode locking, solid state laser, fiber laser

Course Outcomes

After the completion of this course, the student will be able to:

1. Record about the nature of Laser light and different types of laser sources.
2. Describe the processes and methods of laser generation.
3. Analyze subject-specific theories, concepts and principals of laser physics.
4. List laser applications.
5. Summarize information in different types of laser technology.
6. Show effective work skills individually and in team.

<table>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>-</td><td rowspan="2">Project</td><td rowspan="2">10%</td></tr>
<tr><td>Midterm</td><td>30%</td><td>Final</td><td>40%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="8">Laser Physics: From Principles to Practical Work in the Lab, Marc Eichhorn, springer (2014).</td></tr>
<tr><td>References</td><td colspan="8">Milonni, Eberly "Laser Physics", Wiley Interscience, (2010)</td></tr>
</table>

<table>
<tr><td>Course Name</td><td colspan="4">Biophysics</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td colspan="2">Credit Hour</td><td colspan="3">Prerequisite</td></tr>
<tr><td>Phys 421</td><td>0824421</td><td>8</td><td colspan="2">3</td><td colspan="3">Thermal and Statistical Physics (0824401)</td></tr>
<tr><td>Course Track</td><td colspan="8">☐University Requirement ☐College Requirement ☐Specialized Core ☒ Electives</td></tr>
</table>

Course Description

This course covers the following topics: Forces effect on our bodies. Stress - Strain curve. Young's modulus and Shear modulus for materials and biological tissues. Properties of fluids. Viscosity and surface tension. Bernoulli's equation and its applications. Effect of gravity and acceleration on the blood pressure. Nature of sound and sound intensity level. Ultrasound, production and its applications in diagnostic and treatment. Nervous System and electricity within the body. Equilibrium potential and Nernst equation. Factors affecting the propagation of action potential, and the biological effect of different types of radiations and radiation doses.

Course Outcomes

After the completion of this course, the student will be able to:

1. Describe the forces that acting on the different parts of the body.
2. State the fluids inside the body and their effect on our health.
3. Memorize the biological effects of non-ionizing radiation and define Isotopes, diagnoses and radiotherapy.
4. Analyze physical laws in the biological phenomena
5. Compare some of theories related to the laser physics and its medical applications
6. Operate in group as team work to solve problems or to search an information
7. Demonstrate ability to communicate verbally and lettering.

<table>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>-</td><td rowspan="2">Project</td><td rowspan="2">10%</td></tr>
<tr><td>Midterm</td><td>30%</td><td>Final</td><td>40%</td><td>Others</td><td>-</td></tr>
</table>

Textbook	Introduction to Health Physics, by Thomas E. Johnson, 5th Edition, McGraw-Hill Education / Medical, (2017).
References	Medical physics, by: John R. Cameron & James G. Skofronick; Willy John, (2010).

<table>
<tr><td>Course Name</td><td colspan="4">Polymer Physics</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td colspan="2">Prerequisite(s)</td></tr>
<tr><td>Phys 429</td><td>0824429</td><td>8</td><td>3</td><td colspan="2">Thermal and Statistical Physics (0824401)</td></tr>
<tr><td>Course Track</td><td colspan="6">☐University Requirement ☐ College Requirement ☐ Specialized Core ☒Electives</td></tr>
<tr><td colspan="7">Course Description
This course covers the following subjects: This course covers the following topics: Different classification, structures, properties and application of polymers. Processing and synthesis methods for polymers, polymer devices, Preparation of polymer thin films, Characterizations: like XPS, Ramman, SEM, Electrical and optical measurement.</td></tr>
<tr><td colspan="7">Course Outcomes
After the completion of this course, the student will be able to:

1. Recognize the fundamental theories of polymer physics, Properties and Application of polymer physics
2. Describe classification and structure of polymers.
3. Describe polymer thin films, polymer devices, synthesis and characterization.
4. Explain theoretical results with experimental data.
5. Recognize the basics of polymer physics, applications of polymer thin films
6. Use scientific language and analyze problems and ideas.
7. Demonstrate working in groups to solve problems or to search an information in the web.</td></tr>
</table>

<table>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>-</td><td rowspan="2">Project</td><td rowspan="2">10%</td></tr>
<tr><td>Midterms</td><td>30%</td><td>Final</td><td>40%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="8">An Introduction to Polymer Physics, David I. Bower, Cambridge University Press, (2002).</td></tr>
<tr><td>References</td><td colspan="8">Science direct , Organic electronics, Applied physics latter</td></tr>
</table>

<table>
<tr><td>Course Name</td><td colspan="4">Polymer Physics Lab</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td>Course Level</td><td>Credit Hour</td><td colspan="4">Prerequisite(s)</td></tr>
<tr><td>Phys 430</td><td>0824430</td><td>8</td><td>3</td><td colspan="4">Thermal and Statistical Physics, (0824401)</td></tr>
<tr><td>Course Track</td><td colspan="8">☐ University Requirement ☐ College Requirement ☐ Specialized Core ☒ Electives</td></tr>
<tr><td colspan="9">Course Description
This course covers the following topics: Chemical synthesis, Spin coating, Thermal evaporation, Scanning electron microscope, Raman spectroscopy, Optical and electrical measurements.</td></tr>
<tr><td colspan="9">Course Outcomes
After the completion of this course, the student will be able to:
1. Define the chemical synthesis
2. Explain the synthesis and characterization of polymer materials
3. Demonstrate working in groups to solve problems or to search for information in the web.
4. Develop students skills on working together and be team players.
5. Develop students on-line learning skills, using technology platforms in classroom.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Assignment</td><td>-</td><td>Quiz</td><td>-</td><td>Lab</td><td>-</td><td rowspan="2">Project</td><td rowspan="2">-</td></tr>
<tr><td>Midterms</td><td>30%</td><td>Final</td><td>30%</td><td>Others (Reports)</td><td>40%</td></tr>
<tr><td>Textbook</td><td colspan="8">An Introduction to Polymer Physics, David I. Bower, Cambridge University Press, (2002).</td></tr>
<tr><td>References</td><td colspan="8">Science direct , Organic electronics, Applied physics letters</td></tr>
</table>

<table>
<tr><td>Course Name</td><td colspan="4">Electromagnetism1</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td colspan="2">Course Level</td><td colspan="2">Credit Hour</td><td colspan="2">Prerequisite(s)</td></tr>
<tr><td>Phys 303</td><td>0824303</td><td colspan="2">5</td><td colspan="2">3</td><td colspan="2">Mathematical Physics 1, (0824201)</td></tr>
<tr><td>Course Track</td><td colspan="8">☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="9">Course Description
This course covers the following subjects: Dirac Delta function, Coulomb's law, electric field, continuous charge distributions, applications of Gauss's law, Poisson & Laplace equations, method of images, Separation of variables: Cartesian and spherical coordinates, electric field of a dipole, polarization: dielectrics, induced dipoles, the electric field inside a dielectric, bound charges and their physical interpretation, Steady currents, Biot & Savart law, Ampere's law and its application.</td></tr>
<tr><td colspan="9">Course Outcomes
After the completion of this course, the student will be able to:
1. Recognize the basic concepts and methods of electromagnetism and describe how to apply them to simple physical systems.
2. Use mathematical formulation to describe the physical principle or phenomena.
3. Recognize calculations using Coulomb, Gauss, Biot-Savart and Ampere.
4. Explain applications of electromagnetism.
5. Competence to make good and clear scientific discussions with the lecturer and his class mates about the different concepts of electromagnetic physics.
6. Analyze problems with applications of mathematical technique introduced in the course.
7. Use scientific language and analyze problems and ideas.
8. Work in groups.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Homework</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>-</td><td rowspan="2">Project</td><td rowspan="2">10%</td></tr>
<tr><td>Midterms</td><td>30%</td><td>Final</td><td>40%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="8">D. J. Griffiths, Introduction to Electrodynamics, 4th ed., Prentice Hall, (2017).</td></tr>
<tr><td>References</td><td colspan="8">Halliday, et al., Physics Vol. 2, New York, John Wiley & Sons, (2001).</td></tr>
</table>

<table>
<tr><td>Course Name</td><td colspan="4">Electronics 1</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td colspan="2">Course Level</td><td colspan="2">Credit Hour</td><td>Prerequisite</td></tr>
<tr><td>Phys 305</td><td>0824305</td><td colspan="2">5</td><td colspan="2">3</td><td>Mathematical Physics 1 (0824201)</td></tr>
<tr><td>Course Track</td><td colspan="7">University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="8">Course Description

The course covers the following topics: voltage sources, current sources and their equivalent circuits. Basic laws: Ohm's law and Kirchhoff`s law (AC, DC) DC voltage (current), AC voltage (current). Impedance and admittance in parallels and series connections, equivalents. (complex notations) AC Voltage, effective or RMS values Power concept, apparent power and power factor. Mesh analysis, Nodal analysis method mesh analysis method Circuit analysis using PSPICE Voltage divider rule, Current divider rule Thevenin`s theorem, Norton`s theorem, Millman`s theorem, transfer functions, Decibel scale, bode plots, resonance circuits, filters.</td></tr>
<tr><td colspan="8">Course Outcomes
After the completion of this course, the student will be able to:

1. Recognize the basic concepts and methods of Fundamentals of electronics and describe how to apply them to various electric circuits.
2. Use the circuits analysis concept and to solve problems and interpret correctly the results
3. Analyze different electronic circuit problems.
4. Demonstrate the ability of handling different problem solving techniques.
5. Develop scientific language and improve the student analytical abilities.
6. Enhance his critical thinking in solving problem.
7. Promote team-work and self-dependence concerning collecting materials related to the subject of the course.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Homework</td><td>10%</td><td>Quiz</td><td>10%</td><td>Lab</td><td>-</td><td rowspan="2">Project 10%</td></tr>
<tr><td>Midterm</td><td>30%</td><td>Final</td><td>40%</td><td>Others</td><td>-</td></tr>
<tr><td>Textbook</td><td colspan="7">Fundamentals of Electric Circuits 6th Edition By Charles Alexander and Matthew Sadiku, McGraw-Hill, (2017)</td></tr>
<tr><td>References</td><td colspan="7">Electronic principles: Malvino, Albert Paul, 5th ed., Macmillan Publishing Company, (1994).</td></tr>
</table>

Course Name	Nuclear Physics	

Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 404	0824404	7	3	Modern Physics (0824205) Quantum Mechanics 1 (0824307)

Course Track	☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives

Course Description

The course of nuclear physics is devoted to introduce the information about nuclear structure, nuclear models, radioactivity (natural and artificial), radioactive series, secular and permanent equilibrium between isotopes related to the same series, nuclear reactions, fission and fusion, accelerators and nuclear reactors, Radiation detectors, benefits and harmfulness of nuclear radiations, and elementary particles.

Course Outcomes

After the completion of this course, the student will be able to:

1. Memorize the properties of the nucleus and to calculate the binding energy for any nucleus.
2. Record the nuclear models in order to know how they introduce some concepts and illustration of the nucleus properties.
3. Develop the students ability to solve and analyze problems related to the course
4. Show ability to work effectively and independently in groups.
5. Illustrate leadership in (managing time, resources and people).
6. Demonstrate ability to use modern technologies related to course.

Assessment Policy	**Assignment**	10%	**Quiz**	10%	**Lab**	-	**Project**	10%
	Midterm	30%	**Final**	40%	**Others**	-		

Textbook	H.S. Krane, Introductory nuclear physics, Wiley, (2008).
References	David Halliday, Introductory nuclear physics

<table>
<tr><td>Course Name</td><td colspan="5">Research Project</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Course Information</td><td>Course Code</td><td>Course No.</td><td colspan="3">Course Level</td><td colspan="2">Credit Hour</td><td colspan="2">Prerequisite</td></tr>
<tr><td>Phys 405</td><td>0824405</td><td colspan="3">7</td><td colspan="2">2</td><td colspan="2">Gained 96 credits</td></tr>
<tr><td>Course Track</td><td colspan="9">☐ University Requirement ☐ College Requirement ☒ Specialized Core ☐ Electives</td></tr>
<tr><td colspan="10">Course Description

Selected research project Experimental / theoretical work by the faculty member is assigned to the student, requiring a report containing an appropriate description of the research work, acquiring data, data analysis, and conclusion.</td></tr>
<tr><td colspan="10">Course Outcomes
After the completion of this course, the student will be able to:

1. Describe the research topic and state the main objective.
2. Outline the main resources to acquire data.
3. Search for specific topics using library facilities, internet or other information data- base.
4. Develop a research plan and investigate an area of interest.
5. Analyze research data, gain practical skills.
6. Contribute to meaning scholarly pursuits.
7. Work one-on-one with faculty.
8. Demonstrate critical and analytical thinking skills.</td></tr>
<tr><td rowspan="2">Assessment Policy</td><td>Supervisor evaluation</td><td>10%</td><td>Presentation</td><td>30%</td><td>Lab</td><td>-</td><td rowspan="2">Answers to questions</td><td rowspan="2">10%</td><td></td></tr>
<tr><td>Report preparation and scientific contents</td><td>50%</td><td>Final</td><td>-</td><td>HW</td><td>-</td><td></td></tr>
<tr><td>Textbook</td><td colspan="9">Different Journals of Physics</td></tr>
<tr><td>References</td><td colspan="9">-</td></tr>
</table>

Course Name	Solid State Physics Lab				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 412	0824412	8	2	Solid State 1 (0824402)
Course Track	☐University Requirement ☐ College Requirement ☒Specialized Core ☐ Electives				

Course Description

This course covers the following topics: Principles of practical physics, measurements, experimental errors and errors analysis, Electrical conduction in solid bodies, Determining the band gap of Germanium, Hall effect in metals, Investigating the attenuation of x-rays as a function of the absorber material and thickness, Bragg reflection: determining the lattice constant of monocrystals (NaCl and LiF), Duane-Hunt relation and the determination of Planck’s constant, Moseley’s law and the determination of Rydberg constant, Application of x-ray fluorescence for the nondestructive analysis of the chemical composition, Magnetic Hysteresis Loop

Course Outcomes

After the completion of this course, the student will be able to:

1. Reproduce experiments in condensed matter physics related to different mechanisms of electrical conduction in solids, Hall effect, Bragg’s diffraction and x-ray fluorescence.
2. Recall the theoretical bases of the topics related to the experiments, e.g. mechanisms of electrical conduction in solids, Hall effect, dual-nature of matter and x-ray fluorescence.
3. Analyze and interpret the results of laboratory measurements, using equations and graphs.
4. Summarize the theoretical bases of an experiment and compare the practical findings with the literature values.
5. Demonstrate the comprehensive analysis of problems and ideas.
6. Demonstrate work independently and as a part of team on a specific task.
7. Employ computer software and Internet for processing, collecting information and analysing the experimental data.

Assessment Policy	**Assignment**	-	**Quiz**	-	**Lab**	-	**Project**	-
	Midterm	30%	**Final**	30%	**Others (Reports)**	40 %		
Textbook	A. Melissinos & J. Napolitano, Experiments in Modern Physics 2nd edition (2003).							
References	C. Kittel: Introduction to Solid State Physics, 8^{th} Edition (Wiley, 2012),							

Course Name	Summer Training				
Course Information	**Course Code**	**Course No.**	**Course Level**	**Credit Hour**	**Prerequisite**
	Phys 399	0824399	6	3	Gained 79 credits
Course Track	☐University Requirement ☐ College Requirement ☒Specialized Core ☐ Electives				

Course Description

The summer training course is offered after the sixth level at the summer, students are required to successfully finish 79 credits. The main purpose of this course is to provide the students with a real- life experience in the labor market, and to better prepare them for their future endeavors.

Course Outcomes

After the completion of this course, the student will be able to:

1. Have hands on practical in synthesizing different materials such as: films, ceramics nanomaterials, solar cells and energy, polymers, nanoparticles and storage devices.
2. Enhance the students' knowledge in the concepts of functionalized materials science and nanotechnology and applications
3. Enhance the students' knowledge in the concepts related to solar cells operation and energy storage devices.
4. Enhance student ability to collect, analyze ,manipulate data, draw conclusions, and perform error analysis
5. Demonstrate the integration of applied physics knowledge in the fabrication and characterization of different functional materials, solar cells, and the growing field of nanomaterials devices
6. Develop the scientific language, and improve the student analytical abilities.
7. Use computer for analysing and processing the experimental data.

Assessment Policy	**Weekly Reports**	15%	**Final Report**	35%	**Evaluation Training Center**	35%	**Presentation**	15%
Textbook	-							

References	-