

**Kingdom of Saudi Arabia**

**The National Commission for Academic Accreditation & Assessment**

***COURSE SPECIFICATION***

# Course Specification

*For Guidance on the completion of this template, please refer to of Handbook 2 Internal Quality Assurance Arrangements*

Institution: <b>UNIVERSITY OF DAMMAM</b>
College/Department: <b>DEPARTMENT OF PHYSICS</b>

## A Course Identification and General Information

1. Course title and code: <b>Physics for health path, PHYS 104</b>
2. Credit hours: <b>2 lectures + 1 lab</b>
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs)  <b>Preparatory Year Program (Health Discipline).</b>
4. Name of faculty member responsible for the course: <b>Dr. Abdul Rasheed Thamaraserry</b> <b>Dr. Ahmed El-Namrouty</b> <b>Dr. Abdullah Al-Mahasneh</b> <b>Dr. Athiba Khan</b> <b>Dr. Hiba Baha</b> <b>Ms. Amaml Al-Qahtani</b> <b>Ms. Amal Al-Tujjar</b> <b>Ms. Shamma Al-Ghadhban</b>
5. Level/year at which this course is offered: <b>Preparatory Year</b>
6. Pre-requisites for this course (if any): <b>Admission to the program</b>
7. Co-requisites for this course (if any): <b>N/A</b>
8. Location if not on main campus

## B Objectives

<p>1. Summary of the main learning outcomes for students enrolled in the course.</p> <p><b>This course will enable the student to:</b></p> <ul style="list-style-type: none"> <li>• <i>Understand the basic principles of physics that are relevant to medical field.</i></li> <li>• <i>Apply the principles of physics in understanding various body functions.</i></li> <li>• <i>Acquire knowledge about the working principles technological developments in health/medical disciplines.</i></li> </ul>
<p>2. Briefly describe any plans for developing and improving the course that are being implemented. (eg increased use of IT or web based reference material, changes in content as a result of new research in the field)</p> <ul style="list-style-type: none"> <li>• <i>Change the textbook to suit the needs of a preparatory year course (Health Discipline).</i></li> <li>• <i>Intensive use of electronic facilities, such as Smart Board, during lectures.</i></li> <li>• <i>The use of communication media through internet, such as special forums, Google Groups and Facebook for out-of-lecture communication with the students.</i></li> <li>• <i>The use of new educational learning techniques, such as Peer Instruction and Flipped Classroom.</i></li> <li>• <i>Promote the use of Blackboard system provided by the Deanship of E-Learning.</i></li> </ul>

**C. Course Description** (Note: General description in the form to be used for the Bulletin or Handbook should be attached)

1 Topics to be Covered		
Topic	No. of Weeks	Contact hours
<p><b>I. Mechanics</b></p> <p>Mechanics is the branch of physics concerned with the effect of forces on the motion of bodies. It was the first branch of physics that was applied successfully to living systems, primarily to understanding the principles governing the movement of animals. Biomechanics is concerned not only with muscle movement but also with the physical behaviour of bones and organs such as the lungs and the heart. The development of prosthetic devices such as artificial limbs and mechanical hearts is an active area of biomechanical research.</p> <p><b>A. Kinematics</b></p> <ul style="list-style-type: none"> <li>i. <i>Distance and displacement</i></li> <li>ii. <i>Speed and velocity</i></li> <li>iii. <i>Average velocity or speed</i></li> <li>iv. <i>Acceleration</i></li> <li>v. <i>Acceleration due to gravity</i></li> </ul>	1	1

<p><b>B. Force and Newton's laws of motion</b></p> <p><b>1</b></p> <p>i. <i>The concept of force – Newton's laws of motion</i></p> <p>ii. <i>Kinds of forces</i></p>	1	1
<p><b>C. Energy</b></p> <p>i. <i>The concept of energy</i></p> <p>ii. <i>Work</i></p> <p>iii. <i>Kinetic energy</i></p> <p>iv. <i>Potential energy</i></p> <p>v. <i>Conservative forces</i></p> <p>vi. <i>Conservation of total energy</i></p> <p>vii. <i>Power</i></p>	1	1
<p><b>D. Statics</b></p> <p>i. <i>Equilibrium</i></p> <p>ii. <i>Torque</i></p> <p>iii. <i>Principle of moments</i></p> <p>iv. <i>Application in Human body</i></p> <p>v. <i>Centre of gravity</i></p> <p>vi. <i>Stability</i></p>	2	2
<p><b>II. Properties of Fluids</b></p> <p>The study of fluids in motion is closely related to biology and medicine. The blood circulatory system driven by the heart pressure is influenced by the viscosity of blood and the effect of gravity. The laws of physics beautifully explain the flow resistance and pressure drop in blood vessels.</p> <p><b>A. Pressure</b></p> <p>i. <i>Pressure</i></p> <p>ii. <i>Density</i></p> <p>iii. <i>Pascal's principle</i></p> <p>iv. <i>Measurement of pressure</i></p> <p>v. <i>Pressure and human body</i></p>	2	2
<p><b>B. Surface tension and capillarity</b></p> <p>i. <i>Surface tension</i></p> <p>ii. <i>Capillarity</i></p> <p>iii. <i>Surfactant and Lung</i></p>	2	2
<p><b>C. Fluid dynamics and non-viscous fluids</b></p> <p>i. <i>The equation of continuity</i></p> <p>ii. <i>Bernoulli's equation</i></p>	1	1

<p><b>D. Fluid dynamics of viscous fluids</b></p> <ul style="list-style-type: none"> <li>i. <i>Viscosity-Poiseuille's law and blood viscosity</i></li> <li>ii. <i>Turbulence and Reynold's number</i></li> </ul>	<b>1</b>	<b>1</b>
<p><b>III. Thermal properties of matter</b></p> <p>The degree of hotness, or temperature, is one of the most important environmental factors in the functioning of living organisms. The rates of the metabolic processes necessary for life, such as cell divisions and enzyme reactions, depend on temperature. The functioning of most living systems, plants and animals, is severely limited by seasonal variations in temperature. The blood circulatory system and thermal properties of human body governs the temperature regulation and heat transfer mechanisms from the body.</p> <p><b>A. Phase and temperature change</b></p> <ul style="list-style-type: none"> <li>i. <i>States of matter, phase changes and latent heat</i></li> <li>ii. <i>Temperature changes, specific heat</i></li> <li>iii. <i>Energy conservation</i></li> <li>iv. <i>L and c values for water</i></li> </ul>	<b>1</b>	<b>1</b>
<p><b>B. Heat transfer and application to human body</b></p> <ul style="list-style-type: none"> <li>i. <i>Conduction</i></li> <li>ii. <i>Convection</i></li> <li>iii. <i>Radiation</i></li> <li>iv. <i>Combined transfer processes from human body</i></li> </ul>	<b>2</b>	<b>2</b>
<p><b>C. Thermodynamics and body</b></p> <ul style="list-style-type: none"> <li>i. <i>The First law</i></li> <li>ii. <i>Energy and the body</i></li> <li>iii. <i>Thermoregulation</i></li> <li>iv. <i>Temperature and health</i></li> </ul>	<b>1</b>	<b>1</b>
<p><b>IV. Electricity and DC circuits</b></p> <p>Many life processes involve electrical phenomena. The nervous system of animals and the control of muscle movement, for example, are both governed by electrical interactions. Even plants rely on electrical forces for some of their functions.</p> <p><b>A. Electric force and electric field</b></p> <ul style="list-style-type: none"> <li>i. <i>Coulomb's law</i></li> <li>ii. <i>Superposition of electric forces</i></li> <li>iii. <i>Electric field</i></li> <li>iv. <i>Electric field diagrams</i></li> <li>v. <i>Superposition of electric fields</i></li> </ul>	<b>1</b>	<b>1</b>

<p><b>B. Electric potential and energy, capacitor</b></p> <ul style="list-style-type: none"> <li><i>i. Electric potential energy</i></li> <li><i>ii. Electric potential</i></li> <li><i>iii. Electric potential and work</i></li> <li><i>iv. The heart and ECG</i></li> <li><i>v. The capacitor</i></li> </ul>	<b>2</b>	<b>2</b>
<p><b>C. Direct current and DC circuits</b></p> <ul style="list-style-type: none"> <li><i>i. Electric current</i></li> <li><i>ii. Direct and alternating currents</i></li> <li><i>iii. Resistance , resistivity and ohm’s law</i></li> <li><i>iv. Electric shock hazards</i></li> <li><i>v. Electricity in cell</i></li> </ul>	<b>3</b>	<b>3</b>
<p><b>V. Waves, sound and hearing</b></p> <p>Most of the information about our physical surroundings comes to us through our senses of hearing and sight. In both cases we obtain information about objects without being in physical contact with them. The information is transmitted to us in the first case by sound, in the second case by light. Although sound and light are very different phenomena, they are both waves. A wave can be defined as a disturbance that carries energy from one place to another without a transfer of mass. The energy carried by the waves stimulates our sensory mechanisms. The processes of sound production and hearing are governed by the laws of physics.</p> <ul style="list-style-type: none"> <li><i>i. Waves-frequency, wavelength and speed</i></li> <li><i>ii. Types of waves</i></li> <li><i>iii. Sound waves in media</i></li> <li><i>iv. Pitch and loudness</i></li> <li><i>v. Resonance and sound generation</i></li> <li><i>vi. The ear</i></li> </ul>	<b>2</b>	<b>2</b>
<p><b>VI. Optics</b></p> <p>Light is the electromagnetic radiation in the wavelength region between about 400 and 700 nm. Vision is our most important source of information about the external world. It has been estimated that about 70% of a person’s sensory input is obtained through the eye. The three components of vision are the stimulus, which is light; the optical components of the eye, which image the light; and the nervous system. The common defects of vision and their correction are explained using the laws of geometrical optics.</p> <p><b>A. Geometrical optics</b></p> <ul style="list-style-type: none"> <li><i>i. Lenses – image formation by convex and concave lenses</i></li> </ul>	<b>1</b>	<b>1</b>

<p><b>B. The eye and vision</b></p> <ul style="list-style-type: none"> <li>i. <i>The parts of eye</i></li> <li>ii. <i>Emmetropia (normal vision)</i></li> <li>iii. <i>Myopia and correction</i></li> <li>iv. <i>Hypermetropia and correction</i></li> </ul>	<b>1</b>	<b>1</b>
<p><b>VII. Radiation and health</b>  Modern atomic and nuclear physics is among the most impressive scientific achievements of this century. Both the theories and techniques of atomic and nuclear physics have played an important role in the life sciences. The theories provided a solid foundation for understanding the structure and interaction of organic molecules, and the techniques provided many tools for both experimental and clinical work in terms of diagnosis and therapy.</p> <p><b>A. The atomic nuclei and production of ionizing radiation</b></p> <ul style="list-style-type: none"> <li>i. <i>Nuclei and isotopes</i></li> <li>ii. <i>Nuclear decay processes</i></li> <li>iii. <i>Activity and half life</i></li> <li>iv. <i>X – ray production</i></li> </ul>	<b>3</b>	<b>3</b>
<p><b>B. Biological effects of ionizing radiation</b></p> <ul style="list-style-type: none"> <li>i. <i>Mechanism of cell damage</i></li> <li>ii. <i>Dose and dose equivalent</i></li> <li>iii. <i>Types of effect</i></li> <li>iv. <i>Medical effects and risk</i></li> </ul>	<b>1</b>	<b>1</b>
<p><b>C. Medical Imaging</b></p> <ul style="list-style-type: none"> <li>i. <i>X-ray imaging</i></li> <li>ii. <i>CT scan</i></li> <li>iii. <i>PET scan</i></li> <li>iv. <i>Gamma camera</i></li> <li>v. <i>Ultrasound sonography</i></li> </ul>	<b>2</b>	<b>2</b>

2 Course components (total contact hours per semester):			
Lecture: <b>31</b> (One Academic Year)	Tutorial: <b>14</b>	Practical/Fieldwork/Internship: <b>14</b>	Other:

<p>3. Additional private study/learning hours expected for students per week. (This should be an average : for the semester not a specific requirement in each week)</p> <p><i>15 hours</i></p>
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#### 4. Development of Learning Outcomes in Domains of Learning

For each of the domains of learning shown below indicate:

- A brief summary of the knowledge or skill the course is intended to develop;
- A description of the teaching strategies to be used in the course to develop that knowledge or skill;
- The methods of student assessment to be used in the course to evaluate learning outcomes in the domain concerned.

##### **a. Knowledge**

(i) Description of the knowledge to be acquired

- *Understand the basic principles of biomechanics, bioelectricity, wave phenomena, heat and fluid contents of the body, and the biological effects of radiation.*
- *Gain an understanding of the basic principles and the experimental basis of the various fields of physics and their explanations to major biological processes.*
- *Acquire knowledge about the working principles technological developments in health/medical disciplines.*

(ii) Teaching strategies to be used to develop that knowledge

- *Classroom lectures with student-centered components,*
- *Problem-based learning using tutorial sessions,*
- *Home assignments,*
- *Providing popular video lectures,*
- *Laboratory experiments/ demonstrations,*
- *Analysis of experimental observations.*

(iii) Methods of assessment of knowledge acquired

- *Regular quizzes,*
- *Home assignments,*
- *Final examination for theory and laboratory.*

##### **b. Cognitive Skills**

(i) Cognitive skills to be developed

- *Problem solving using theoretical knowledge,*



<ul style="list-style-type: none"> <li>• <i>Competence to analyze experimental data and to draw valid conclusions,</i></li> <li>• <i>Develop competence in using computers for computation, data acquisition, analysis and interpretation.</i></li> </ul>
<p>(ii) Teaching strategies to be used to develop these cognitive skills</p> <ul style="list-style-type: none"> <li>• <i>Classroom lectures with student-centered components,</i></li> <li>• <i>Problem-based learning using tutorial sessions,</i></li> <li>• <i>Laboratory experiments/ demonstrations,</i></li> <li>• <i>Analysis of experimental observations.</i></li> </ul>
<p>(iii) Methods of assessment of students cognitive skills</p> <ul style="list-style-type: none"> <li>• <i>Regular quizzes,</i></li> <li>• <i>Home assignments,</i></li> <li>• <i>Tutorial sessions,</i></li> <li>• <i>Final examination for theory and laboratory.</i></li> </ul>
<p><b>c. Interpersonal Skills and Responsibility</b></p>
<p>(i) Description of the interpersonal skills and capacity to carry responsibility to be developed</p> <ul style="list-style-type: none"> <li>• <i>Punctual attendance of class room sessions</i></li> <li>• <i>Students take responsibility to work out assignments on his own and submit in time</i></li> <li>• <i>Students learn to manage time in self-study of the course material</i></li> </ul>
<p>(ii) Teaching strategies to be used to develop these skills and abilities</p> <ul style="list-style-type: none"> <li>• <i>Assignments are given to students at regular intervals to solve and submit on time</i></li> <li>• <i>Active participation in class room discussions and tutorial sessions.</i></li> </ul>
<p>(iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility</p> <ul style="list-style-type: none"> <li>• <i>Class room attendance of students at the beginning of the class.</i></li> <li>• <i>Recording the submission of assignments and marking participation in discussions and tutorials</i></li> </ul>
<p><b>d. Communication, Information Technology and Numerical Skills</b></p>
<p>(i) Description of the skills to be developed in this domain.</p>

<ul style="list-style-type: none"> <li>• <i>Develop the English communication skills</i></li> <li>• <i>Develop skills to prepare and present short topics</i></li> <li>• <i>Develop problem solving skills</i></li> </ul>
<p>(ii) Teaching strategies to be used to develop these skills</p> <ul style="list-style-type: none"> <li>• <i>Asking the students to prepare and present brief presentations /solve a problem during lectures</i></li> <li>• <i>Promoting to watch video lectures at home and asking to explain it in class rooms.</i></li> <li>• <i>Promote the use of English in such brief presentations and correcting mistakes.</i></li> </ul>
<p>(ii) Methods of assessment of students numerical and communication skills</p> <ul style="list-style-type: none"> <li>• <i>Through the students score in test and assignments</i></li> <li>• <i>Evaluation of performance in reports, assignments and participation in tutorials and discussions</i></li> </ul>
<p><b>e. Psychomotor Skills (if applicable)            NA</b></p>
<p>(i) Description of the psychomotor skills to be developed and the level of performance required.</p>
<p>(ii) Teaching strategies to be used to develop these skills.</p>
<p>(iii) Methods of assessment of students psychomotor skills.</p>

5. Schedule of Assessment Tasks for Students During the Semester			
Assessment	Assessment task (eg. essay, test, group project, examination etc.)	Week due	Proportion of Final Assessment
1	Quizzes (3)		45%
2	Home assignments, reports, lab reports		5%
3	Lab exam		10%
4	Final exam		40%

## D. Student Support

1. Arrangements for availability of faculty for individual student consultations and academic advice. (include amount of time faculty are available each week)

- Each faculty is required to be available in his office to devote at least 10 hours per week for students consultation and academic advice

## E Learning Resources

1. Required Text(s)

- Introduction to Biological Physics for Health and Life Sciences by Kristen Franklin (Wiley 2012)

Essential References

- *Physics for health sciences* by Carl Nave & Brenda Nave, Saunders Publishing(1985)
- *Physics* by Kane and Sternheim Wiley (1988).
- *Lab Manual describing specific laboratory experiments. (Prepared by the staff of Physics Department, College of Medicine).*

3- Recommended Books and Reference Material (Journals, Reports, etc) (Attach List) NA

4-.Electronic Materials, Web Sites etc

1. <http://www3.nd.edu/~nsl/Lectures/mphysics/>
2. <http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html>
3. <http://www.physicsclassroom.com/mop/module.cfm>
4. <http://www.physicsclassroom.com/mop/module.cfm>
5. <http://www.physicsclassroom.com/mop/module.cfm>
6. <http://whs.wsd.wednet.edu/faculty/busse/mathhomepage/busseclasses/apphysics/studentguides/chapter1718/ex18-6solution.html>
7. <http://bcs.whfreeman.com/thelifewire/content/chp44/4402s.swf>
8. [https://www.google.com.sa/search?q=action+potential+animation&hl=ar&prmd=imvns&source=univ&tbm=vid&tbo=u&sa=X&ei=IQV4T6CpCMLO4QS12\\_j2Dg&ved=0CFMQqwQ&biw=1600&bih=691](https://www.google.com.sa/search?q=action+potential+animation&hl=ar&prmd=imvns&source=univ&tbm=vid&tbo=u&sa=X&ei=IQV4T6CpCMLO4QS12_j2Dg&ved=0CFMQqwQ&biw=1600&bih=691)
9. <http://www.somalidoc.com/ppt.htm>

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

- *The instructor can provide them on a time to time basis.*

## F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (ie number of seats in classrooms and laboratories, extent of computer access etc.)
1. Accommodation (Lecture rooms, laboratories, etc.) <ul style="list-style-type: none"><li>• <i>Lecture rooms equipped with white boards, smart boards and internet connection.</i></li></ul>
2. Computing resources <ul style="list-style-type: none"><li>• <i>Access to internet and computer facility on a common basis.</i></li></ul>
3. Other resources (specify --eg. If specific laboratory equipment is required, list requirements or attach list)  The laboratory equipments are purchased annually, assessing the requirements.

## G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching <ul style="list-style-type: none"><li>• <i>Student course evaluation through student assessment forms – done by Quality Assurance Unit.</i></li></ul>
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department <ul style="list-style-type: none"><li>• <i>Student interview</i></li><li>• <i>Peer review</i></li><li>• <i>Faculty assessment of course effectiveness and teaching delivery</i></li><li>• <i>Periodic self-assessments</i></li></ul>
3 Processes for Improvement of Teaching <ul style="list-style-type: none"><li>• <i>The Departmental Council and Quality Assurance unit review the deficiencies based on student evaluation, faculty input, course file and program assessment.</i></li></ul>
4. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution) <ul style="list-style-type: none"><li>• <i>The departmental council reviews samples of students work in this course to check on the standard of grades and achievements.</i></li></ul>
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. <ul style="list-style-type: none"><li>• <i>Both self and external assessments are carried out. The feedback received from these assessments is used in planning further improvement in the course.</i></li><li>• <i>Accreditation process.</i></li></ul>