دبلوم دراسات عليا في الفيزياء الإشعاعية

يهدف برنامج دبلوم الفيزياء الإشعاعية إلى:

1. تزويد الطلاب بالمعرفة والتقنيات المختلفة للإشعاع التطبيقي في الطب والسلامة غير الواضحة والوقاية من الإشعاع.
2. الدبلوم الممنوح بترخيص من اختصاصي فيزياء الصحة وزارة الصحة المصرية لكي يتاح للطالب للتعامل مع أنواع مختلفة من الإشعاع.
3. تمكين الطلاب من تصميم دروع مختلفة لأنواع مختلفة من الإشعاع في المواقع التي تستخدم مصدر الإشعاع.
4. تزويد الطالب بالتأثيرات البيولوجية المختلفة للإشعاع على النظم البيولوجية والبيئة المحيطة.
5. تزويد الطلاب بأساسيات مراقبة الجودة للأجهزة والطب والصناعة.

هيكل و مكونات البرنامج :

الكود	نوع المقرر	عدد المقررات	عدد الساعات المعتمدة
Phys500 & Phys600 ف500- ف600	اجبارى	يدرس الطالب عدد (12) مقررا المبينة فى الجدول	24
	اختيارى	--	--
		اجمالى عدد الساعات المعتمدة المطلوبة	24

المقررات الإجبارية Compulsory Courses

الفصل الدراسي	كود المقرر	اسم المقرر	نظرى	عملى	عدد الساعات المعتمدة	ملاحظات
الفصل الدراسى الأول	Phys669 ف669	قياسات إشعاعية ودوزومترية Radiation Dosimetry	2	-	2	
	Phys621 ف621	الرياضيات الحيوية Mathematical Biology	2	-	2	

	2	-	2	فيزياء العلاج الاشعاعى Physics of Radiation Therapy	Phys515 ف515	
	2	-	2	فيزياء صحية Health Physics	Phys666 ف666	
	2	-	2	تشريح و فسيولوجى Anatomy and Physiology	Phys516 ف516	
	2	-	2	فيزياء الاشعة التشخيصية (1) Physics of Diagnostic Radiations (1)	Phys661 ف661	
	2	-	2	قياسات ضوئية Optical Measurements	Phys651 ف651	الفصل الدراسى الثانى
	2	-	2	بيولوجيا ووقاية إشعاعية Radiobiology and Radiation Protection	Phys517 ف517	
	2	-	2	الاحصاء التجريبى والنمذجه Experimental Statistical	Phys650 ف650	
	2	-	2	التصوير الاشعاعى المقطعى Topographic Imaging	Phys518 ف518	
	2	-	2	فيزياء الاشعة التشخيصية (2) Physics of Diagnostic Radiations (2)	Phys664 ف664	
	2	-	2	معالجة الصور Image Processing	Phys519 ف519	

Contents

Health Physics Course_666Phys

Introduction to Interaction of Radiation with Matter
Beta Particles - Alpha Particles - Gamma Rays - Neutrons

Radiation Dosimetry
Units - External Exposure - Internally Deposited Radionuclides - External Exposure: Neutrons

Biological Basis for Radiation Safety

Dose–Response Characteristics - The Physiological Basis for Internal Dosimetry - Radiation Effects: Deterministic - Radiation Effects: Stochastic - Radiation-Weighted Dose Units: The Sievert and The Rem

Radiation Safety Guides
Organizations That Set Standards - Philosophy of Radiation Safety - ICRP Basic Radiation Safety Criteria - United States Nuclear Regulatory Program - Ecological Radiation Safety

Health Physics Instrumentation
Radiation Detectors - Particle-Counting Instruments - Dose-Measuring Instruments
Neutron Measurements – Calibration - Counting Statistics

External Radiation Safety
Basic Principles - Optimization

Internal Radiation Safety
Internal Radiation - Principles of Control - Surface Contamination Limits - Waste Management Assessment of Hazard - Optimization

Criticality
Criticality Hazard - Nuclear Fission – Criticality - Nuclear Reactor - Criticality Control - **Required Textbook**

1- Herman Cember, and Thomas E. Johnson, Introduction to Health Physics, Fourth Edition, The McGraw-Hill Companies, 2009.

2- Khan, Faiz M, and John P. Gibbons the physics of radiation therapy, Fifth edition, Lippincott Williams & Wilkins, A Wolters Kluwer Business, 2014.

3- Jacob Van Dyk, The Modern Technology of Radiation Oncology, A Compendium For Medical Physicists And Radiation Oncologists, Library of Congress Cataloging-in-Publication Data, 1999.

Mathematical Biology (Phys 610)

- Introduction to Mathematical Biology
- Dimensional analysis
- Linear growth equation
- Linear growth population
- Exponential growth population
- Logistic growth model
- Voltera model of single species

- Deterministic and Stochastic models of Epidemiology

References

- J. D. Murray, Mathematical Biology: I. An Introduction (2002).
- A. Morega, M. Morega, A. Dobre, Computational Modeling in Biomedical Engineering and Medical Physics (2020).

Physics of diagnostic radiation (1) phys 661

1. **Interaction of X-Rays and Gamma Rays with Matter**
2. **Interaction of electrons with matter**
3. **Production of X-Rays**
4. **Radiographic image of the x-ray**

References:

1. **Physics for diagnostic radiology**
   Third Edition
   Pp Dendy, B Heaton

2. **Diagnostic radiology physics**
   Hand book (IAEA)
   D.R.Dance
   S. Christofides
   I.D.Mclean
   K. H. Ng

Physics of Radiotherapy Treatment -Phys 515

- Structure of matter and radioactivity.
- Classification of radiation and its origin.
- Types of photon matter interaction.
- Biological effects of radiation: Somatic and hereditary effects in humans, long and short –term somatic effects, radiation induced cancer, dose response curve.
- Effect of acute dose to specific organs or tissues: skin, blood, reproductive system, thyroid, eye and central nervous system.

- Treatment planning.
- Radiation therapy treatment parameters.
- Radiotherapy Treatment devices: EBT, IGRT, IMRT, VMAT, CT/CAT, PET and MRI.

- **Radiation measurements and Dosimetry- Phys 669**
- **Contents**
- **- Classification of Radiation.**
- 1. Electromagnetic radiation
- 2. Particulate radiation
- 3. Ionizing and non-ionizing radiations.
- - Stopping power in compounds and mixtures - Linear energy transfer (LET)
- Radiation quantities and Units- Introduction and Overview. Radiation Units
- - Conventional Units -SI Unit - Specific Quantities and Their Associated Units
- - Photon Concentration (Fluence), A Factor in Image Quality
- - Energy, Exposure- Air Kerma- Surface Integral Exposure -Dose Area Product - Absorbed Dose
- -Computed Tomography (CT) Dose Index - Mammography Mean Glandular Dose - Integral Dose - Computed Tomography Dose Length Product - Dose Equivalent - Effective Dose - Tissue Weighting Factors
- **Dosimetry**
- Introduction and Overview- Direct & Indirect monitoring -What is Dosimetry?
- 1. Personal dosimetry
- 2. Indirect monitoring using measured dose rates or airborne concentrations of nuclear substances
- 3. Indirect monitoring using environmental pathways analysis
- 4. Dose Concepts
- About dose limits - Limits on effective doses - Prescribed Effective & Equivalent Dose Limits - External Dosimetry –
- About Dosimeters:
- - General characteristics- Choosing a dosimeter- Dosimeter type testing
- - Dosimetry for photon and beta radiation - Thermoluminescent dosimeters (TLDs)
- Instrumentation for Dosimetry
- - Radiation detectors and dosimeters –

- 1. General characteristics of radiation detectors
- 2. Properties of diagnostic radiology dosimeters - Sensitivity, Linearity, Energy dependence, Leakage Current.
- 3. Ionization chambers
- Clinical application of ionization chambers- Chambers for air kerma (dose) measurements - Cylindrical pencil type chambers - KAP (kerma area product) chambers
- 4. Semiconductor dosimeters
- 5. Film dosimetry: Radiographic film and radiochromic film
- 6. (OSL dosimeter)
- Dosimetric applications of TLD and OSL- Dosimeter Calibration – Shielding Gamma Rays & Exposure Rate- Basic principles of radiation protection - Gamma Rays Attenuation & Half Value Layer - Solved Examples
- **References**
- - Radiation detection and measurement - Knoll - Cited by 17365
- - Radiation Dosimetry: Physical and Biological Aspects - C.G. Orton
- - Introduction to Radiation Protection Dosimetry - Baoshan Weng & Jozef Sabol

Phys. 650: Experimental Statistics and Modeling

Contents

References

1. Allman E. S., Rhodes J. A., ***Mathematical Models in Biology: An Introduction*** (Cambridge University Press, Cambridge, 2004)
2. Murray J. D., ***Mathematical biology: An introduction***-3rd edition (Springer-Verlag, Berlin, 2002)

Course Title: Image Processing -Phys 519

Course content:

• Introduction - Elements of digital image processing - Image model - Sampling and quantization - Relationships between pixels

• Image Transforms - Discrete Fourier Transform - Discrete Cosine Transform - Haar Transform - Hadamard Transform

• Image Enhancement - Enhancement by point processing - Spatial filtering - Enhancement in the frequency domain - Color Image Processing

• Image Segmentation - Discontinuity detection - Edge linking and boundary detection - Thresholding - Region oriented segmentation

• Representation and Description - Boundary description - Regional description

• Morphological Image Processing - Dilation and Erosion - Opening and Closing - Some basic morphological algorithms - Extensions to gray level images

Module references –

R. C. Gonzalez and R. E. Woods, "Digital Image Processing". Pearson-Prentice-Hall, 2008.

- Al Bovik (ed.), "Handbook of Image and Video Processing", Academic Press, 2000.

- A.K. Jain, "Fundamentals of Digital Image Processing", Prentice-Hall, Addison-Wesley, 1989.

- M. Petrou, P. Bosdogianni, "Image Processing, The Fundamentals", Wiley, 1999.

- P.Ramesh Babu, Digital Image Processing. Scitech Publications., 2003

- Bernd Jähne, Digital Image Processing, Springer-Verlag Berlin Heidelberg 2005.

- B. Jähne, "Practical Handbook on Image Processing for Scientific Applications", CRC Press,1997.

- J. C. Russ. The Image Processing Handbook. CRC, Boca Raton, FL, 4th edn., 2002.

- J. S. Lim, "Two-dimensional Signal and Image Processing" Prentice-Hall, 1990. - Rudra Pratap, Getting Started With MATLAB 7. Oxford University Press, 2006

- W. K. Pratt. Digital image processing, PIKS Inside. Wiley, New York, 3 rd , edn., 2001.

- Stephane Marchand-Maillet, Yazid M. Sharaiha, Binary Digital Image Processing, A DiscreteApproach, Academic Press, 2000

Course name: Optical Measurements 651 Phys

- Course main subject: Colour measurements
- Course subtitles :

1 – Colour Perception
2 – Colour Measurement
3 – Colour Scales
4 – Surface Characteristics and Geometry
5 – Sample Preparation and Presentation

- References:

1 – www.hunterlab.com

2 – G. Wyszecki and W. S. Stiles, "*Colour Science: Concepts and Methods, Quantitative Data and Formulae",* 2nd ed. (John Wiley & Sons, New York, 1982).

Physics of diagnostic radiation(2) phys 664

1. Tomographic Imaging with X-Rays
2. Diagnostic Imaging with Radioactive Materials
3. Diagnostic Ultrasound

References

3. Physics for diagnostic radiology
Third Edition
Pp Dendy, B Heaton

4. Diagnostic radiology physics
Hand book (IAEA)
D.R.Dance
S. Christofides
I.D.Mclean

Radiobiology and Radiation Protection - Phys517

- **Nature and Origin of Radiation**

Electromagnetic radiation, Particle radiation, Decay law, Radiation and dosimetry units, Interaction of radiation with matter and Natural radioactivity.

- **Biological Effects of Radiation**

Conditions of the radiation exposure, Energy loss effects, Dose response curves, Direct and indirect action of radiation,

- **Principles of Radiation Protection**

Justification and justification of medical practices, Optimization of protection and medical practices, Dose limitation, International basic safety standards

- **Radiation Monitors**

Servey and personal monitors

Topographic Image course _518 Phys:-

1. Chapter one:
   Introduction
2. Chapter two:
   Classification of Radiation: electromagnetic, ionizing, and non-ionizing radiations……
3. Chapter three:
   X-ray production: tube, anode, and hounse field units……
4. Chapter four:
   Interactions of radiation with matter: photoelectric effect, Compton scattering, and pair production……
5. Chapter five:
   The CT imaging system: gantry, table, generator, and detectors……
6. Chapter six:
   Image reconstruction and processing
7. Chapter seven:
   CT image quality

References:-

1. Diagnostic Radiology Physics:
   By; D.R. Dance, et.al.
2. Basic physics of nuclear medicine:
   By; Kieran Maher.
3. The essential physics of medical imaging (3rd edition):

By; Jerrold T. Bushberg, et.al.