M.Sc. Degree in Medical Physics

The objectives of the Master of Medical Physics are as follows:

1. To provide the community with distinguished graduates in the field of medical physics.
2. To provide students with basic knowledge, skills and scientific research methodologies in the field of medical physics to solve real problems in society.
3. Granting of opportunities to learn scientific research in medical physics and related fields.
4. To provide students with more knowledge and skills necessary to conduct scientific research in medical physics and related fields.
5. Qualifying students to update and develop their experiences by providing them with specialized professional knowledge and skills in medical physics using modern technological means for self-learning.
6. Students acquire the specialized professional skills to write and publish scientific research in medical physics and related fields.
7. To provide the graduate with the ethics of scientific research, the ethical and legal principles, and the fundamentals of quality in the field of medical physics study.

هيكل و مكونات البرنامج :

(يقبل الطلاب من برامج الفيزياء الطبية - الفيزياء - فيزياء و كيمياء)

الكود	نوع المقرر	عدد المقررات	عدد الساعات المعتمدة
Phys600 ف 600	اجبارى	يدرس الطالب عدد (6) مقررات المبينة فى الجدول	12
	اختيارى	يختار الطالب عدد (4) مقررات من بين (6) المظللة فى الجدول بواقع مقررين فى كل فصل دراسى	8
	اجبارى	رسالة الماجستير (اجبارى)	20
		اجمالى عدد الساعات المعتمدة المطلوبة	40

الفصل الدراسى	كود المقرر	اسم المقرر	نظرى	عملى	عدد الساعات المعتمدة	ملاحظات
الفصل الدراسى الأول	Phys660 ف660	فيزياء العلاج الاشعاعى Physics of Radiation Therapy	2	-	2	المقررات الإجبارية
	Phys661 ف661	فيزياء الاشعة التشخيصية (1) Physics of Diagnostic Radiations (1)	2	-	2	
	Phys662 ف662	تشريح و فسيولوجى Anatomy and Physiology	2	-	2	
	Phys665 ف665	معالجة الصورة Image Processing	2	-	2	يختار مقررين
	Phys666 ف666	فيزياء صحية Health Physics	2	-	2	
	Phys667 ف667	البيولوجيا الجزيئية Molecular Biology	2	-	2	
الفصل الدراسى الثانى	Phys663 ف663	فيزياء حيوية جزيئيه Molecular Biophysics	2	-	2	المقررات الإجبارية
	Phys664 ف664	فيزياء الاشعة التشخيصية (2) Physics of Diagnostic Radiations (2)	2	-	2	
	Phys650 ف650	الاحصاء التجريبى و النمذجة Experimental Statistical and Modeling	2	-	2	
	Phys668 ف668	بيولوجيا اشعاعية Radiation Biology	2	-	2	يختار مقررين
	Phys669 ف669	قياسات إشعاعية ودوزومترية Radiation Measurements & Dosimetry	2	-	2	
	Phys651 ف651	قياسات ضوئية Optical Measurements	2	-	2	

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.

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

- # 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

3. Nonlinear Models of Interactions

3.1. A Simple Predator-Prey Model
3.2. Equilibria of Multi-population Models
3.3. Linearization and Stability
3.4. Positive and Negative Interactions
  3.4.1. Competition model
  3.4.2. Immune system vs. infective agent
  3.4.3. Mutualism model

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 665

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