زانکۆی پۆلیتەکنیکی هەولێر
ERBIL POLYTECHNIC UNIVERSITY

(Module Name) Course Catalogue

2022-2023

College	**Medical Technical Institute- Erbil**	
Department	**Radiology**	
Module Name	**Radiation Physics**	
Module Code	**RAP 21**	
Semester	**2**	
Credit		
Module type	**Prerequisite, Core, Aissist.**	
Weekly hours	**8**	
Weekly hours (Theory)	**(2)hr Class**	**( )hr Workload**
Weekly hours (Practical)	**(6)hr Class**	**( )hr Workload**
Lecturer (Theory)	**Dr. Sarwar I. Saleh**	
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Lecturer (Practical)	**Dr. Sarwar I. Saleh + Ruaa Imad Husain**	
Email		

Course Book

- **Course overview:**

This lecture is intended as an assistant textbook in radiation physics and its applications in diagnostic radiological techniques in applied academic medical graduate programs. The lecture may also be of interest for the large number of professional physicists, who in their daily occupations deal with medical physics and have a need to improve their understanding of radiation physics and to all medical postgraduate programs.

- **Course objective:**

This lecture is based on notes that we developed over the past years of teaching radiation physics to students in radiological techniques department at the college of medical technology. It contains two chapters, each chapter covering a specific group of subjects related to radiation physics that form the basic knowledge required from professionals working in different medical imaging fields.

- **Student's obligation**

In contrast to other physics specialties, such as nuclear physics, solid-state physics, and high-energy physics, studies of modern medical physics attract a much broader base of professionals including graduate students in medical imaging residents and technology students in diagnostic imaging and therapeutic radiation oncology, students in biomedical engineering, and students in radiation safety and radiation dosimeter educational programs. All these professionals have a common desire to improve their knowledge of the physics that underlies the application of radiation in diagnosis and treatment of disease.

- **Forms of teaching**

lecture halls with data show equipment for lecture presentations, white board, overhead projector, posters

- **Assessment scheme**

6% Mid. Theory exam
10% Mid. practical exam
4% Quiz
40% Activity
25% final practical
15% final theory

- **Specific learning outcome:**

1- Radiation physics and its applications in diagnostic radiological techniques.
2- The interest for the large number of professional physicists, who in their daily occupations deal with medical physics.
3- To improve their understanding of radiation physics and to all medical postgraduate programs.
4- Covering a specific group of subjects related to radiation physics that form the basic knowledge required from professionals working in different medical imaging fields.

5- All these professionals have a common desire to improve their knowledge of the physics that underlies the application of radiation in diagnosis and treatment of disease.

- **Course Reading List and References:**

THE PHYSICS OF RADIOLOGY AND IMAGING/ K Thayalan

- **Course topics (Theory)**	**Week**	**Learning Outcome**
Fundamental Concepts/ MATTER AND ENERGY/ Measurement and units/	1	
Density, mole, pressure, and gas laws	2	
Mechanics/ **VELOCITY AND ACCELERATION/ SCALAR AND VECTOR QUANTITIES/ FORCE/ WORK/ POWER/ ENERGY/ Potential Energy/ Kinetic Energy/**	3	
MOMENTUM/ TEMPERATURE AND HEAT/ Celsius Scale/ Kelvin Scale/ Fahrenheit Scale	4	
HEAT/ Conduction/ Convection/ Radiation/ HEAT CAPACITY	5	
ATOMIC STRUCTURE/ ATOMIC NUMBER AND MASS NUMBER/ EFFECTIVE ATOMIC NUMBER/ ISOTOPES/ ELECTRON SHELLS/ QUANTUM NUMBER/ IONIZATION/ BINDING ENERGY/ EXCITATION/ ELECTRON VOLT	6	
ELECTROMAGNETIC RADIATION/ WAVE CHARACTERISTICS/ PARTICLE CHARACTERISTICS/ MASS ENERGY EQUIVALENCE/ ELECTROMAGNETIC SPECTRUM/ IONIZING RADIATION AND NON-IONIZING RADIATION/ FLUORESCENCE/ INVERSE SQUARE LAW/ Electricity, Electronics and Magnetism/ ELECTRICAL FORCE AND FIELD/ ELECTRICAL POTENTIAL/ CONDUCTORS, INSULATORS AND SEMICONDUCTORS	7	
N-type Semiconductor/ P-type Semiconductor/ SEMICONDUCTOR DIODE/ TRANSISTORS/ CAPACITANCE/ CAPACITOR/ ELECTRICAL CURRENT/ DIRECTION OF CURRENT/ OHM'S LAW/ RESISTANCE/ SUPERCONDUCTIVITY/ ELECTRICAL POWER/ HEATING EFFECT OF AN ELECTRIC CURRENT/ MAGNETIC FIELD AND FLUX DENSITY/ MAGNETIC INDUCTION/ MAGNETIC PROPERTIES/ ALTERNATING CURRENT/ AC GENERATOR/	8	

Physics of X-rays/ Discovery of X-rays/ Production of X-rays/ X-ray tube design/ Historical X-ray tubes/ Modern X-ray tubes/ **STATIONARY ANODE X-RAY TUBE/ ROTATING ANODE X-RAY TUBE/ Grid Controlled X-ray Tubes/ HEEL EFFECT/ OFF-FOCUS RADIATION/ X-RAY TUBE AND HOUSING/**	9	
SCATTERED RADIATIONS/ BEAM RESTRICTORS OR COLLIMATORS/ QUALITY AND INTENSITY OF X-RAYS/ HALF-VALUE LAYER (HVL)/ FACTORS AFFECTING QUALITY AND INTENSITY/	10	
Radiation Units and Interactions with Medium/ Fluence and Flux/ ACTIVITY/ EXPOSURE – ROENTGEN/ KERMA/	11	
Mass Energy Transfer Coefficient/ ABSORBED DOSE – GRAY/RAD/ Mass Energy Absorption Efficient/ ROENTGEN-RAD CONVERSION FACTOR/ Conversion of Exposure from Dose in Air/ RELATIVE BIOLOGICAL EFFECTIVENESS (RBE)/ EQUIVALENT DOSE AND EFFECTIVE DOSE/ RADIATION INTERACTION WITH MATTER/ ATTENUATION/ Linear Attenuation Coefficient (□□/Mass Attenuation Coefficient (□/□□/Attenuation Coefficient and Beam Energy/ Half Value Layer/	12	
- **Practical Topics (If there is any)**	**Week**	**Learning Outcome**
Fundamental Concepts/ Measurement and units/	1	
Mechanics/ **VELOCITY AND ACCELERATION/ SCALAR AND VECTOR QUANTITIES/ FORCE/**	2	
ELECTROMAGNETIC RADIATION/ WAVE CHARACTERISTICS/ PARTICLE CHARACTERISTICS/ MASS ENERGY EQUIVALENCE/ ELECTROMAGNETIC SPECTRUM/	3	
CAPACITANCE/ CAPACITOR/	4	
ELECTRICAL CURRENT/ DIRECTION OF CURRENT/ OHM'S LAW/ RESISTANCE/	5	
Physics of X-rays /Production of X-rays/ X-ray tube design/	6	
FACTORS AFFECTING QUALITY AND INTENSITY/	7	
Radiation Units and Interactions with Medium	8	
Attenuation Coefficient	9	
Mass Energy Transfer Coefficient/ ABSORBED DOSE – GRAY/RAD/	10	

CONVERSION FACTOR/ Conversion of Exposure from Dose in Air/	11	
Half Value Layer	12	

- **Examinations (question design):**

Q1/ Define the followings.
Q2/ Fill the following blanks.
Q3/ Solve the following mathematical question.
Q4/ Enumerate the followings.

- **Extra notes:**

- **External Evaluator**