Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2015/2016

COURSE NAME	:	PHYSICS OF DIAGNOSTIC RADIOLOGY
COURSE CODE	:	BWC 40803
PROGRAMME	:	4 BWC
EXAMINATION DATE	:	DECEMBER 2015 / JANUARY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) X-ray tube consists of several components. Describe the name and explain the function of each component.

(4 marks)

(b) What is the ratio of energy converted to heat and energy converted to photon in X-ray production?

(4 marks)

(c) The filament inside the X-ray tube is normally made using element such as tungsten, rhenium or molybdenum. Why this particular element is used as cathode material?

(6 marks)

(d) Explain how "target angle" give influence on the size of focus spot for X-ray tube.

(6 marks)

Q2 (a) Explain the function of the following X-ray generator components;

(i) tube housing
(ii) collimator
(iii) X-ray beam filtration
(iv) focusing cup

(4 marks)

(b) Define the term of "anode heel effect" and explain in detail why this particular effect can reduce the X-ray intensity.

(4 marks)

(c) X-ray filtration technique is useful in generating appropriate X-ray intensity in radiography. Differentiate between unfiltered and filtered X-rays, and explain the advantages of using filtered X-ray.

(6 marks)

(d) X-ray tube for radiography purpose is normally consisting of two types of filaments, which are small and large filaments. Distinguish the function of both filaments.

(6 marks)

Q3 (a) High kinetic energy electron is bombarded on the target at range of target angle between 7 and 15 degree. Distinguish the focal spot of X-ray that emitted from the X-ray tube housing at target angle of 7 and 15 degree.

(4 marks)

(b) X-ray anode for radiography is made from tungsten. There are two types of anode, which are stationary and rotating anodes. Distinguish the mechanism of X-ray production for both types of anode.

(4 marks)

(c) Define the term of X-ray tube rating charts and state the rule in order to use these charts.

(4 marks)

(d) In radiography process, 10 exposures have been done within 0.43 sec at X-ray setting of 80 kilo volt potential, kVp and 200 mA using high frequency X-ray unit. If the rectification constant, Cr for high frequency unit is 1.43, calculate the heat unit (HU) produced by this X-ray tube.

(8 marks)

Q4 (a) Classify the basic components of projection radiography system.

(4 marks)

(b) Attenuation phenomenon in radiography such as scattering effect can be reduced the X-ray imaging quality Suggest the best method to reduce this X-ray scattering effect, and explain in detail its mechanism.

(6 marks)

(c) Differentiate between film screen and digital radiography detectors.

(4 marks)

(d) In X-ray imaging, the scattering effect can be classified into four categories. List all of these categories and differentiate between detected and undetected Compton scattering.

(6 marks)

Q5 (a) In radiography imaging, there are two types of digital radiography (DR) imaging techniques, which consists of indirect digital radiography and direct digital radiography. Differentiate the mechanism of both techniques.

(4 marks)

(b) Latent image formation is different in computed radiography (CR) and direct radiography (DR). Differentiate the mechanism of image formation between CR and DR.

(4 marks)

(c) Computed tomography and fluoroscopy are a common radiography imaging technique. Differentiate between both techniques in term of the image resolution, and suggest which is the best imaging technique.

6 marks)

(d) A patient receives an injection 1.1×10^8 Bq of iodine, ^{131}I, which accumulates in the thyroid ($m_{thyroid} = 20g$). The mean energy of the emitted radiation, E is 300 keV. Calculate the dose rate to thyroid in Gray per second, Gys^{-1}.

(6 marks)

-END OF QUESTION-

LIST OF FORMULA

$Heat\ Unit, HU = Voltage, V\ x\ Current, I\ x\ Times, t\ x\ Rectification\ constant, C_r x\ Number\ of\ exposure, N$
$Absorbed\ Dose\ Rate, DR = Activity, A\ x \frac{Radiation\ Energy, E}{mass\ of\ material, m}$