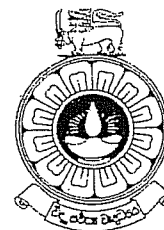


THE OPEN UNIVERSITY OF SRI LANKA  
 BACHELOR OF SCIENCE DEGREE PROGRAMME – LEVEL 05  
 MEDICAL PHYSICS -PYU 3167



No Book Test -1 , 2016/2017

Duration: ONE HOUR (1 hr)

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 Date 30<sup>th</sup> September 2017

Time 4.00 pm – 5.00 pm  
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Answer all questions

- 1.(a). Explain briefly the “Population Inversion” and its impotency in LASER production .
  - (b). How is the ultrasound used in medicine produced? Explain briefly.
  - (c). Distinguish three ultrasound imaging modes used in the medical diagnosis.
  - (d). State where a coupling medium or gel is used in an ultrasound scan and explain why it is necessary.
  - (e). If the speed of ultrasound in liver is  $1566 \text{ ms}^{-1}$  and the density of the liver is  $1070 \text{ kg m}^{-3}$ , calculate the intensity reflection coefficient of ultrasound when penetrating from fat to liver. Acoustic impedance of fat is  $1.33 \times 10^6 \text{ Kg m}^{-2} \text{ s}^{-1}$ .
  - (f). Ultrasound with 14 MHz frequency is used to examine the liver of a patient. The sound travels for 40 ms through the body before returning to the probe. If the average speed of sound in the body is  $1500 \text{ ms}^{-1}$ , estimate the distance to the liver from the surface of the skin.
2. (a). Explain how, the use of a contrast medium improves the quality of an X-ray photo.
  - (b). Calculate the percentage of the intensity of X-rays not absorbed after passing through 1.0 cm of, bone and the half-value thickness for bone. Linear attenuation coifeicent of the bone is  $300 \text{ m}^{-1}$ .

(c). X-rays interact with tissue in two main ways, list them.

(d). What is the mass of a 1.05  $\mu\text{Ci}$  carbon-14 ( $^{14}\text{C}$ ) source. The half-life for  $^{14}\text{C}$  is 5730 years.

(e). The radioactive isotope Indium-111 ( $^{111}\text{I}$ ) is often used for diagnosis and imaging in nuclear medicine. Its half life is 2.8 days. What was the initial mass of the isotope before decay, if the mass in 2 weeks was 5g?

(f). Xenon -133 ( $^{133}\text{Xe}$ ) , a radioactive inert gas is used for lung function studies. It s physical half-life is 5.3 days and the biological half-life in lungs is about 0.35 minutes. Determine the effective half-life of  $^{133}\text{Xe}$  in the lungs.

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