

Sample Part IIA (written) question in Imaging Physics

10-mark Question

Question:

- a) What is a Modulation Transfer Function (MTF) used in assessing the quality of medical imaging? (3 marks)
- b) Draw a MTF curve for an IDEAL imaging device and label the axes clearly. (2 marks)
- c) In radiological imaging, what is contrast resolution and how is it affected by noise? (3 marks)
- d) In radiological imaging, what is spatial resolution? (2 marks)

Marking Scheme:

Part a)

- i. description of modulation, e.g.

Objects having different sizes and opacity are displayed with different gray-scale values on an image. (1 mark)

- ii. description of what is transferred or converted in an imaging process, e.g.

MTF converts contrast values of different-sized objects (object contrast) into contrast intensity levels in the image (image contrast). (1 mark)

- iii. description of MTF, e.g.

MTF is the spatial frequency response of an imaging system. (1 mark)

Part b)

- i. correct MTF curve (1 mark)
- ii. correct labelling of both axes (1 mark)

Part c)

- i. description of contrast resolution, e.g.

In radiological imaging, the contrast resolution describes the ability of an imaging modality to produce an image that can discriminate between tissues with slight differences in attenuation properties in the object. (1 mark)

- ii. how contrast resolution is expressed, e.g.

The contrast resolution is usually expressed as the minimum detectable size of an object structure for a fixed percentage difference in contrast relative to the adjacent background. (1 mark)

- iii. relation of contrast resolution to noise, e.g.

The contrast resolution is limited by noise and is closely associated with the radiation dose. In general, a reduction of the dose affects the visibility of structures with low contrast due to increased noise. (1 mark)

Part d)

- i. description of spatial resolution, e.g.

In radiological imaging, the spatial resolution describes the ability of an imaging modality to display two closely spaced objects as two separate image structures. (1 mark)

- ii. how spatial resolution is expressed, e.g.

The spatial resolution is usually expressed by the size and spacing of two closely spaced objects just resolvable, e.g. in line pairs per cm etc. (1 mark)