Unit 3 - Week 1

Course outline

How does an NPTEL online course work?

Week 0

Week 1

- Lecture 1 : Introduction to Medical Image Analysis
- Lecture 2 : X Ray and CT Imaging
- Lecture 3 : Magnetic Resonance Imaging
- Lecture 4 : Ultrasound Imaging
- Lecture 5 : Optical Microscopy and Molecular Imaging
- Week 1 : Lecture Slides
- Quiz : Assignment 1
- Week 1 Feedback Form

Week 2

Week 3

Week 4

DOWNLOAD VIDEOS

Solutions

Assignment 1

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-03-04, 23:59 IST.

1) What is the kinetic energy of a particle having wavelength of 2 pm. (Planck's constant $= 6.6 \times 10^{-34}$ J-sec) *1 point*

(a) 98 μJ
(b) 99 μJ
(c) 99 μJ
(d) None of these

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(b)

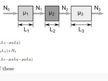
2) Calculate the Larmor frequency of a molecule subjected to a magnetic field of 3 T. ($\gamma = 42.58$ MHz/T) *1 point*

(a) 14.19 MHz
(b) 127.74 MHz
(c) 28.39 MHz
(d) 100.28 MHz

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(b)

3) In figure shown below the μ_1, μ_2, μ_3 are the attenuation coefficient of the 3 different materials given. The materials are of length L_1, L_2, L_3 respectively. Calculate the value of N_2 *1 point*

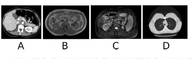


(a) $N_0 e^{(-\mu_1 L_1 - \mu_2 L_2)}$
(b) $N_0 e^{(-\mu_1 L_1 + N_1}$
(c) $N_0 e^{(-\mu_1 L_1 - \mu_2 L_2 - \mu_3 L_3)}$
(d) None of these

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(b)

4) Identify the imaging modality *1 point*



A B C D

(a) A - CT, B - T1 weighted MRI, D- T2 weighted MRI, D - T1 weighted MRI
(b) A - CT, B- T1 weighted MRI, C - T2 weighted MRI, D - CT
(c) A - T2 weighted MRI, B - CT, C- T1 weighted MRI, D - X ray
(d) A - T2 weighted MRI, B - CT, C - T1 weighted MRI, D - CT

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(b)

5) Consider the scheme shown in the following figure for ultrasound imaging of soft tissue. Given the point P shown in the figure, find the propagation time for the jth transducer for beamforming in ultrasound scanning. Assume point O to be the origin of the coordinate system and length of each transducer 1 mm. Given, $R_{fp} = 10$ cm, $\theta = 15°$, speed of sound in soft tissue = 1,540. *1 point*

(a) 1.93 μs
(b) 6.49 ms
(c) 6.28 ms
(d) 64.46 μs

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(d)

6) Anaconda platform is used for programming with which language? *1 point*

(a) Lua
(b) C++
(c) Python
(d) C

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(c)

7) What is the estimated market of medical image analysis in year 2020? *1 point*

(a) 86 Million
(b) 86 Billion
(c) 83.5 Million
(d) 83.5 Billion

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(d)

8) What is the Hounsfield unit of bone if the attenuation coefficients of bone and water are 0.375 and 0.214 respectively. *1 point*

(a) 1677.57
(b) -1677.57
(c) 2.67
(d) -2.67

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a)

9) Which among the following is a Journal on machine learning (ML)? *1 point*

(a) ICML
(b) ACML
(c) CVPR
(d) None of these

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(d)

10) What is the frequency of ultrasound used for imaging fetus? *1 point*

(a) 3 MHz
(b) 100 MHz
(c) 15 MHz
(d) None of these

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a)

11) Choose the correct statement *1 point*

(a) T1 relaxation time in MRI can be longer or shorter than T2 relaxation time for liver tissue
(b) T1 and T2 relaxation time in MRI are equal for liver tissue
(c) T1 relaxation time in MRI is longer than T2 relaxation time for liver tissue
(d) T2 relaxation time in MRI is longer than T1 relaxation time for liver tissue

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(c)

12) Consider a 1.5 T MRI scanner with a slice encoding gradient of 10 mT/m. What should be the step size in scanning frequency to achieve a slice resolution of 10 mm? *1 point*

(a) 4.258 MHz
(b) 4.258 MHz
(c) 42.58 MHz
(d) 4.258 Hz

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(d)

13) Which is the specialist literature for medical image analysis? *1 point*

(a) IEEE Trans. Biomedical Engineering
(b) ACM Trans. Graphics
(c) Medical Image Analysis
(d) None of these

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(c)

14) From the following list of ultrasound frequencies, choose the best one for imaging of the heart. *1 point*

(a) 3 MHz
(b) 10 MHz
(c) 100 MHz
(d) 20 MHz

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a)

15) What kind of microscope is used for fluorescence imaging? *1 point*

(a) Transmission light microscope
(b) Both transmission and reflected light microscope
(c) Reflected light microscope
(d) None of these

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(c)

16) Calculate the angular aperture for a lens having numerical aperture 0.5. Consider air as the medium. *1 point*

(a) 30°
(b) 60°
(c) 64.4°
(d) 15°

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a)

17) In optical microscopy, what kind of artifact is observed in relation with high numerical aperture? *1 point*

(a) Saturation
(b) Airy disk effect
(c) Blurring
(d) None of these

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(c)

18) What is the relation between depth of focus and numerical aperture in optical microscope? *1 point*

(a) No relation
(b) Depth of focus decreases with increase in numerical aperture
(c) Depth of focus increases with increase in numerical aperture

(a)
(b)
(c)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(c)

19) Arrange the following materials in increasing order of acoustic impedance. A - Adipose tissue, B - Brain tissue, C - Compact bone, D - Liver *1 point*

(a) A<B<D<C
(b) C<B<D<A
(c) A<D<B<C
(d) C<D<B<A

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(c)

20) Let P_1 and P_2 be the pressure of the echo pulse received corresponding to frequencies f_1 and f_2 in ultrasound imaging. If $f_1 > f_2$, what is the relation between P_1 and P_2? *1 point*

(a) $P_1 > P_2$
(b) $P_1 < P_2$
(c) $P_1 = P_2$
(d) There is no relation between pressure of echo pulse and frequency.

(a)
(b)
(c)
(d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(c)