



BRAINWARE UNIVERSITY

Term End Examination 2024-2025

Programme – B.Sc.(MRIT)-2022

Course Name – Physics of Advanced Imaging Equipment-MRI

Course Code - BMRITC501

(Semester V)

Full Marks : 60

Time : 2:30 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 15=15

1. Choose the correct alternative from the following :

- (i) Define the Larmor frequency.
 - a) The frequency at which protons rotate around their own axis
 - b) The frequency at which protons align with the external magnetic field
 - c) The frequency at which nuclear spins precess in a magnetic field
 - d) The frequency at which the magnetic field strength is applied
- (ii) State the effect of increasing magnetic field strength on Larmor frequency.
 - a) Decreases linearly
 - b) Remains constant
 - c) Increases linearly
 - d) Fluctuates randomly
- (iii) Define transverse relaxation (T2).
 - a) The time taken for protons to align with the magnetic field
 - b) The time it takes for spins to lose coherence in the transverse plane
 - c) The time required for longitudinal magnetization to return
 - d) The frequency shift observed in MR images
- (iv) Select the parameter that determines image contrast in T1-weighted images.
 - a) TR (Repetition Time)
 - b) TE (Echo Time)
 - c) Proton density
 - d) Gradient strength
- (v) Identify the primary component of an MRI system responsible for generating the static magnetic field . static magnetic field.
 - a) Gradient coils
 - b) Superconducting magnet
 - c) RF coil
 - d) Shim coil
- (vi) Select the function of the radiofrequency (RF) coil in an MRI machine.
 - a) Creates the primary magnetic field
 - b) Transmits and receives signals from tissues

- c) Produces gradient fields
(vii) Identify the purpose of the RF shielding in the MRI room.
a) Prevents heat from escaping the magnet
b) Protects the magnet from external magnetic interference
c) Prevents external radiofrequency signals
d) Reduces noise generated by the gradient coils
- (viii) Select the component that monitors and controls the temperature of the superconducting magnet.
a) RF coil
b) Gradient amplifier
c) Cryogenic cooling system
d) Shim coil
- (ix) Illustrate the reason for using a superconducting magnet in MRI instead of a resistive magnet.
a) To reduce the size of the MRI machine
b) To generate stronger magnetic fields with less power consumption
c) To improve the quality of RF pulses
d) To lower the cost of MRI scanning
- (x) Identify the imaging artifact caused by inhomogeneity in the magnetic field.
a) Gibbs ringing
b) Susceptibility artifact
c) Chemical shift artifact
d) Magnetic field distortion artifact
- (xi) Choose the mechanism used to improve patient comfort during MRI scans.
a) Active noise control
b) Gradient strength reduction
c) Open-bore magnet design
d) Faster acquisition time
- (xii) State the type of coil used to homogenize the magnetic field.
a) Gradient coil
b) Shim coil
c) Receive coil
d) Transmit coil
- (xiii) Choose the advantage of RF shielding in MRI rooms.
a) Reduces acoustic noise
b) Protects from static magnetic fields
c) Blocks external RF interference
d) Enhances image contrast
- (xiv) Select which of the following describes the main function of the RF transmitter coil.
a) To create the main magnetic field
b) To create image slices
c) To transmit radio waves to excite protons
d) To enhance signal reception
- (xv) Define the role of the RF receiver coil in MRI.
a) Create the gradient fields
b) Excite the protons
c) Detect the emitted signals from the body
d) Improve magnetic field strength

Group-B

(Short Answer Type Questions)

3 x 5=15

(Answer any Five from the following)

2. Describe the basic principles of MRI. (3)
3. Differentiate between T1 and T2 weighted image characteristic. (3)
4. Define gradient coils and their role in spatial encoding in MRI. (3)
5. Explain the importance of hydrogen in MRI. (3)
6. Categorize the different types of MRI pulse sequences and their specific applications in clinical imaging. (3)

OR

Differentiate between spin echo (SE) and gradient echo (GRE) pulse sequences in terms of their characteristics and uses.

Group-C

(Long Answer Type Questions)

5 x 6=30

(Answer any Six from the following)

7. Elaborate gradient coil used in MRI. (5)
8. Infer spin echo pulse sequence with proper diagram. (5)
9. Differentiate between turbo spin echo and inversion recovery sequences. (5)
10. Explain the role of magnetic field gradients in MRI, and how do they enable spatial encoding of the MR signal? (5)
11. Describe the physical basis of nuclear magnetic resonance (NMR) and how it is applied in MRI to differentiate between different tissue types. (5)
12. Illustrate MRI magnet in details. (5)

OR

Elaborate MRI pulse sequences. (5)

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