

Advanced Electrical Engineering Concepts

Electrical Engineering · Practice Test · 10 Questions

1. What is the fundamental principle behind the operation of a bipolar junction transistor (BJT) that distinguishes it from a field-effect transistor (FET)?

- A) The control of current is primarily achieved by an electric field applied to a gate electrode.
- B) It relies on the injection of minority carriers across a forward-biased junction.
- C) The input impedance is generally very high due to a gate insulator.
- D) It exhibits a transconductance characteristic that is proportional to the square of the gate-source voltage.

2. In the context of power systems, what is the primary purpose of a synchronizer when connecting a generator to the grid?

- A) To limit the inrush current during connection.
- B) To ensure the generator's voltage, frequency, and phase angle match the grid.
- C) To automatically adjust the generator's excitation for optimal power factor.
- D) To provide overcurrent protection for the generator.

3. Which Maxwell's equation, in its integral form, describes the relationship between the magnetic flux through a closed surface and the absence of magnetic monopoles?

- A) Gauss's Law for Electricity: $\oint \mathbf{E} \cdot d\mathbf{A} = Q_{enc} / \epsilon_0$
- B) Faraday's Law of Induction: $\oint \mathbf{E} \cdot d\mathbf{l} = -d\Phi_B/dt$
- C) Gauss's Law for Magnetism: $\oint \mathbf{B} \cdot d\mathbf{A} = 0$
- D) Ampère-Maxwell Law: $\oint \mathbf{B} \cdot d\mathbf{l} = \mu_0 I_{enc} + \mu_0 \epsilon_0 d\Phi_E/dt$

4. In digital signal processing, what is the Nyquist-Shannon sampling theorem fundamentally concerned with?

- A) The maximum amplitude of a signal that can be represented.
- B) The minimum sampling rate required to perfectly reconstruct a continuous-time signal from its samples.
- C) The bandwidth limitation of digital-to-analog converters.
- D) The precision with which analog signals can be quantized.

5. What is the primary function of a Faraday cage?

- A) To amplify electromagnetic signals.
- B) To shield its interior from external static and non-static electric fields.
- C) To generate high-frequency electromagnetic radiation.
- D) To store electrical energy indefinitely.

6. In control systems, what does a Bode plot typically represent?

- A) The step response of a system over time.
- B) The root locus of a system's poles and zeros.
- C) The frequency response of a system, showing gain and phase shift versus frequency.
- D) The impulse response of a system.

7. What is the phenomenon described by the Hall effect?

- A) The generation of a voltage difference across an electrical conductor, transverse to an electric current in the conductor and a magnetic field perpendicular to the current.
- B) The emission of electrons from a heated surface.
- C) The inverse piezoelectric effect.
- D) The interaction between two parallel current-carrying wires.

8. Which type of electric motor is characterized by a rotating magnetic field produced by AC currents in the stator, which induces a current in the rotor, causing it to rotate?

- A) DC shunt motor
- B) Universal motor
- C) Permanent magnet synchronous motor
- D) Induction motor

9. What is the primary advantage of using a MOSFET compared to a BJT in many modern electronic circuits?

- A) Higher current gain
- B) Faster switching speeds at low current densities
- C) Lower input impedance
- D) Higher input impedance and lower power consumption for the control signal

10. In power electronics, what is the main role of a snubber circuit connected in parallel with a switching device (like a MOSFET or IGBT)?

- A) To increase the switching frequency.
- B) To limit the rate of voltage rise (dV/dt) across the switch during turn-off and absorb switching energy.
- C) To provide a path for the load current when the switch is off.
- D) To improve the power factor of the circuit.