CUET PG 2026 Electronics & Communication Engineering Question Paper with Solutions(Memory Based)

Time Allowed :1 Hours 30 minutes	**Maximum Marks :**300	**Total Questions :**75

General Instructions

1. The exam lasts 90 minutes (1 hour 30 minutes).
2. There are 75 Multiple Choice Questions (MCQs) to be answered.
3. +4 marks for every correct answer. -1 mark (negative marking) for every incorrect answer. 0 marks for unanswered or un-attempted questions.
4. For any discrepancy in questions, the English version is considered final (except for language-specific papers).
5. Click one of the four options to choose an answer.
6. You must click "Save & Next" to confirm your response. Only saved answers are considered for evaluation.
7. Use "Mark for Review & Next" to flag a question for later. You can unselect or change your answer using the "Clear Response" button.
8. All calculations must be done on the Rough Sheets provided at the centre. These must be returned to the invigilator after the exam.

1. What is the Thevenin equivalent voltage across a load in an open-circuited network?

(A) Short-circuit current
(B) Open-circuit voltage
(C) Load voltage
(D) Internal resistance

Correct Answer: (B) Open-circuit voltage

Solution:

Step 1: Understanding the Concept:
Thevenin's Theorem allows any linear electrical network to be simplified into an equivalent circuit consisting of a single voltage source and a series resistance.
The Thevenin equivalent voltage (V_{th}) is defined as the potential difference measured between two terminals when the load is removed.

Step 2: Key Formula or Approach:
The fundamental relationship for the Thevenin voltage is:

$$V_{th} = V_{\text{open-circuit}}$$

Step 3: Detailed Explanation:
In an open-circuit condition, the resistance between the terminals is infinite ($R \to \infty$).
According to Ohm's Law ($V = IR$), since no current can flow into an open circuit ($I = 0$), there is no voltage drop across any internal resistors within the network.
Therefore, the voltage appearing at the output terminals is exactly equal to the total internal voltage of the source, which is defined as the Thevenin voltage.
- Option (A) is the Norton equivalent current (I_{sc}).
- Option (C) depends on the value of the load connected.
- Option (D) refers to the Thevenin resistance (R_{th}).

Step 4: Final Answer:
The Thevenin equivalent voltage is the open-circuit voltage across the terminals.

> Quick Tip
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> To find V_{th} in a circuit diagram, simply remove the load resistor and calculate the voltage at the open terminals using KVL or nodal analysis.

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2. Which semiconductor device is primarily used as a voltage regulator?

(A) LED
(B) Zener diode
(C) Photodiode
(D) Transistor

Correct Answer: (B) Zener diode

Solution:

Step 1: Understanding the Concept:
A voltage regulator is a device designed to maintain a constant DC voltage level despite variations in input voltage or load current.

Step 2: Detailed Explanation:
A Zener diode is a special type of p-n junction diode that is highly doped and designed to operate specifically in the reverse breakdown region.
Unlike standard diodes, the Zener diode does not get destroyed when it reaches its breakdown voltage (V_z).
In the breakdown region, the voltage across the Zener diode remains almost constant even if the current through it increases significantly.
By placing a Zener diode in parallel with a load, any excess voltage is suppressed, and the load receives a steady, regulated voltage equal to V_z.
- LEDs are used for light emission.

- Photodiodes are used for light detection.
- Transistors are primarily used for switching or amplification.

Step 3: Final Answer:
The Zener diode is the primary device used for shunt voltage regulation due to its stable reverse breakdown characteristic.

Quick Tip

Always connect the Zener diode in reverse bias for regulation purposes. In forward bias, it acts like a normal diode with a 0.7V drop.

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3. Calculate the Nyquist rate for a signal with a maximum frequency component of 5 kHz.

(A) 5 kHz
(B) 10 kHz
(C) 2.5 kHz
(D) 20 kHz

Correct Answer: (B) 10 kHz

Solution:

Step 1: Understanding the Concept:
The Nyquist Sampling Theorem states that to accurately reconstruct a signal from its samples without aliasing, the sampling frequency must be at least twice the maximum frequency component of the signal.

Step 2: Key Formula or Approach:
The Nyquist rate is defined as:

$$f_s = 2 \times f_{\max}$$

Step 3: Detailed Explanation:
Given the maximum frequency component ($f_{\max}$) = 5 kHz.
Applying the formula:

$$\text{Nyquist Rate} = 2 \times 5 \text{ kHz} = 10 \text{ kHz}$$

Sampling at exactly 10 kHz is the minimum requirement; sampling at any rate lower than this will cause spectral overlapping (aliasing).

Step 4: Final Answer:
The Nyquist rate for the 5 kHz signal is 10 kHz.

Quick Tip

Nyquist Rate $= 2 \times f_{\text{max}}$.
Nyquist Interval $= 1/(2 \times f_{\text{max}})$.

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4. How many flip-flops are required to build a MOD-16 counter?

(A) 2
(B) 3
(C) 4
(D) 5

Correct Answer: (C) 4

Solution:

Step 1: Understanding the Concept:
A MOD-N counter is a digital circuit that cycles through N unique states.
A counter built with n flip-flops can have a maximum of 2^n distinct states.

Step 2: Key Formula or Approach:
To find the required number of flip-flops (n), we use the inequality:

$$2^n \geq N$$

where n must be the smallest integer satisfying the condition.

Step 3: Detailed Explanation:
For a MOD-16 counter, $N = 16$.
We test values of n:
If $n = 3$, $2^3 = 8$ (Too small, as $8 < 16$).
If $n = 4$, $2^4 = 16$ (Exact match, as $16 \geq 16$).
Thus, 4 flip-flops are needed to represent binary states from 0000 to 1111 (0 to 15).

Step 4: Final Answer:
4 flip-flops are required to build a MOD-16 counter.

Quick Tip

Number of flip-flops = $\log_2(N)$. If the result is a decimal, always round up to the next whole number.

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5. Which type of power amplifier has the highest theoretical efficiency?

(A) Class A
(B) Class B
(C) Class AB
(D) Class C

Correct Answer: (D) Class C

Solution:

Step 1: Understanding the Concept:
Efficiency in power amplifiers is defined as the ratio of AC output power to DC input power. It depends on the conduction angle of the active device.

Step 2: Detailed Explanation:
- **Class A:** Conducts for the full cycle (360°). Theoretical max efficiency is 25% to 50%.
- **Class B:** Conducts for half the cycle (180°). Theoretical max efficiency is 78.5%.
- **Class AB:** Conducts between 180° and 360°. Efficiency is between Class A and B.
- **Class C:** Conducts for less than 180° (usually very small portion). Because the transistor is "OFF" for most of the cycle, power dissipation is minimal.
Theoretical efficiency for Class C can reach 90% to 100%, though it introduces high distortion.

Step 3: Final Answer:
Class C power amplifiers have the highest theoretical efficiency among the given options.

Quick Tip

Efficiency order: Class C > Class B > Class AB > Class A.
Linearity order: Class A > Class AB > Class B > Class C.

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6. In a Common Emitter (CE) configuration, what is the phase shift between input and output?

(A) 0°
(B) 90°
(C) 180°
(D) 270°

Correct Answer: (C) 180°

Solution:

Step 1: Understanding the Concept:
Transistor amplifiers vary in their phase relationships. A phase shift indicates whether the output signal is inverted relative to the input.

Step 2: Detailed Explanation:
In a Common Emitter amplifier, the input is applied to the base and the output is taken from the collector.
When the input base voltage increases, the collector current increases.
This increased current causes a larger voltage drop across the collector resistor (R_C).
Since $V_{\text{out}} = V_{CC} - I_C R_C$, a larger drop results in a lower output voltage.
Thus, an increase in input results in a decrease in output, which is a 180° inversion.

Step 3: Final Answer:
The phase shift in a CE configuration is 180°.

Quick Tip

Common Emitter = 180° Phase Shift.
Common Base = 0° Phase Shift.
Common Collector = 0° Phase Shift.

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7. What is the relationship between the bandwidth and the Q-factor in a resonant circuit?

(A) $Q = BW$
(B) $Q = f_0/BW$
(C) $Q = BW^2$
(D) $Q = BW/f_0$

Correct Answer: (B) $Q = f_0/BW$

Solution:

Step 1: Understanding the Concept:
The Quality factor (Q) measures the sharpness of resonance, while bandwidth (BW) is the range of frequencies over which the circuit operates effectively.

Step 2: Key Formula or Approach:
The relationship is defined by:

$$Q = \frac{f_0}{BW}$$

where f_0 is the resonant frequency.

Step 3: Detailed Explanation:
A high Q factor indicates a very narrow bandwidth, making the circuit highly selective (good for tuning).
Conversely, a low Q factor indicates a wide bandwidth, meaning the circuit responds to a broader range of frequencies.

Step 4: Final Answer:
Q is the ratio of resonant frequency to bandwidth.

Quick Tip
Q and Bandwidth are inversely proportional for a fixed resonant frequency.

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8. Which Maxwell's equation represents Faraday's Law of Induction?

(A) $\nabla \cdot \mathbf{E} = \frac{\rho}{\varepsilon_0}$
(B) $\nabla \cdot \mathbf{B} = 0$
(C) $\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$
(D) $\nabla \times \mathbf{B} = \mu_0 \mathbf{J} + \mu_0 \varepsilon_0 \frac{\partial \mathbf{E}}{\partial t}$

Correct Answer: (C) $\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$

Solution:

Step 1: Understanding the Concept:
Faraday's Law of Induction states that a time-varying magnetic field induces an electromotive force (EMF), which creates an electric field.

Step 2: Detailed Explanation:
Maxwell's differential form of this law relates the curl of the electric field ($\mathbf{E}$) to the rate of change of the magnetic field ($\mathbf{B}$).

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$$

- (A) is Gauss's Law for electric fields.
- (B) is Gauss's Law for magnetism (no monopoles).
- (D) is the Ampere-Maxwell Law.

Step 3: Final Answer:
The equation $\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$ represents Faraday's Law.

Quick Tip

The negative sign in the equation represents Lenz's Law, which states that induced effects oppose the change.

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9. A MOSFET operates in the saturation region when the gate-to-source voltage exceeds what?

(A) Drain voltage
(B) Threshold voltage
(C) Source voltage
(D) Gate voltage

Correct Answer: (B) Threshold voltage

Solution:

Step 1: Understanding the Concept:
The threshold voltage (V_{th}) is the minimum gate-to-source voltage (V_{GS}) required to create a conduction channel between the drain and source.

Step 2: Detailed Explanation:
- If $V_{GS} < V_{th}$, the MOSFET is in the cut-off region (no current).
- If $V_{GS} > V_{th}$, the MOSFET turns "ON".
Once the device is ON, it can be in the linear (triode) or saturation region depending on the drain-to-source voltage (V_{DS}).
The fundamental condition to even enter the saturation region is that V_{GS} must first exceed V_{th}.

Step 3: Final Answer:
The MOSFET requires $V_{GS} > V_{th}$ to operate in the saturation region.

Quick Tip

Saturation condition: $V_{GS} > V_{th}$ AND $V_{DS} \geq V_{GS} - V_{th}$.

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10. What is the Z-transform of a unit impulse function $\delta[n]$?

(A) z
(B) $1/z$
(C) 1
(D) $1/(1 - z^{-1})$

Correct Answer: (C) 1

Solution:

Step 1: Understanding the Concept:
The Z-transform of a discrete-time signal $x[n]$ is defined as the sum of $x[n]z^{-n}$ over all n.

Step 2: Key Formula or Approach:

$$X(z) = \sum_{n=-\infty}^{\infty} x[n]z^{-n}$$

Step 3: Detailed Explanation:
The unit impulse function $\delta[n]$ is defined as 1 only at $n = 0$ and 0 elsewhere.
Applying the transform:

$$X(z) = \delta[0]z^{-0} + \delta[1]z^{-1} + \dots$$

$$X(z) = 1 \cdot 1 + 0 + 0 \cdots = 1$$

Step 4: Final Answer:
The Z-transform of $\delta[n]$ is 1.

> Quick Tip
>
> Impulse in time domain $\leftrightarrow$ Unity in frequency/Z domain.

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11. Which modulation technique is more immune to noise: AM or FM?

(A) AM
(B) FM
(C) Both equally
(D) None

Correct Answer: (B) FM

Solution:

Step 1: Understanding the Concept:
Noise in the transmission channel typically affects the amplitude of the signal.

Step 2: Detailed Explanation:
- In **Amplitude Modulation (AM)**, information is stored in the amplitude. Since noise

changes the amplitude, it directly distorts the information.
- In **Frequency Modulation (FM)**, information is stored in the frequency variations, while the amplitude is kept constant.
FM receivers use limiters to clip noise-induced amplitude variations without losing information, making FM much more noise-resistant.

Step 3: Final Answer:
FM is more immune to noise than AM.

Quick Tip
FM provides better SNR (Signal to Noise Ratio) at the cost of higher bandwidth.

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12. In digital logic, what is the dual of the OR operation?

(A) NOT
(B) AND
(C) XOR
(D) NAND

Correct Answer: (B) AND

Solution:

Step 1: Understanding the Concept:
The principle of duality in Boolean algebra states that any logic identity remains valid if you swap operators and identity elements.

Step 2: Key Formula or Approach:
To find a dual:
1. Replace OR (+) with AND ($\cdot$).
2. Replace AND ($\cdot$) with OR (+).
3. Replace 0 with 1 and 1 with 0.

Step 3: Detailed Explanation:
The OR operation is represented as $A + B$.
Swapping the operator according to the duality rules gives $A \cdot B$, which is the AND operation.

Step 4: Final Answer:
The dual of OR is AND.

Quick Tip

Duality is NOT the same as Complement (De Morgan's). Variables remain uncomplemented in duality.

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13. What is the characteristic impedance of a lossless transmission line?

(A) $\sqrt{R/G}$
(B) $\sqrt{L/C}$
(C) R/L
(D) G/C

Correct Answer: (B) $\sqrt{L/C}$

Solution:

Step 1: Understanding the Concept:
The characteristic impedance (Z_0) is the ratio of voltage and current waves in a transmission line.

Step 2: Key Formula or Approach:
The general formula is:

$$Z_0 = \sqrt{\frac{R + j\omega L}{G + j\omega C}}$$

Step 3: Detailed Explanation:
For a **lossless** line, the resistance (R) and conductance (G) are zero.
Substituting $R = 0$ and $G = 0$:

$$Z_0 = \sqrt{\frac{j\omega L}{j\omega C}} = \sqrt{\frac{L}{C}}$$

Step 4: Final Answer:
The characteristic impedance is $\sqrt{L/C}$.

Quick Tip

For lossless lines, Z_0 is purely resistive (real number).
