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

Time Allowed :1 Hours 30 min	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: (2) Open-circuit voltage

Solution:

Concept: Thevenin's Theorem states that any linear electrical network can be replaced by an equivalent circuit consisting of a single voltage source (Thevenin voltage) in series with a resistance (Thevenin resistance).
Step 1: Understanding Thevenin voltage.
The Thevenin equivalent voltage (V_{th}) is defined as the voltage measured across the output terminals when no load is connected.
Step 2: Open-circuit condition.
When the circuit is open (no load connected), no current flows, and the voltage across the terminals is called the open-circuit voltage.
Step 3: Relation to Thevenin voltage.

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

Step 4: Eliminating other options.

- Short-circuit current: Used to find Norton equivalent
- Load voltage: Depends on load, not open circuit
- Internal resistance: Refers to R_{th}

Step 5: Conclusion.
Thus, Thevenin equivalent voltage is the open-circuit voltage.

> **Quick Tip**
>
> V_{th} = Open-circuit voltage across terminals.

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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: (2) Zener diode

Solution:

Concept: Voltage regulation is essential in electronic circuits to maintain a constant output voltage despite variations in input voltage or load conditions.
Step 1: Understanding Zener diode.
A Zener diode is a special type of diode designed to operate in the reverse breakdown region.
Step 2: Working principle.
When reverse voltage reaches the Zener breakdown voltage, the diode maintains a constant voltage across it.
Step 3: Application in regulation.

- Used in voltage regulator circuits
- Maintains steady output voltage
- Protects circuits from voltage fluctuations

Step 4: Eliminating other options.

- LED: Emits light
- Photodiode: Detects light
- Transistor: Used for amplification/switching

Step 5: Conclusion.
Thus, the Zener diode is primarily used as a voltage regulator.

> **Quick Tip**
>
> Zener diode $\rightarrow$ Maintains constant voltage $\rightarrow$ Used in voltage regulation.

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1. 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: (2) 10 kHz

Solution:

Concept: According to the Nyquist Sampling Theorem, the minimum sampling rate required to avoid aliasing must be at least twice the maximum frequency present in the signal.
Step 1: Nyquist rate formula.

$$\text{Nyquist Rate} = 2 \times f_{\text{max}}$$

Step 2: Substitute given value.

$$= 2 \times 5\,\text{kHz} = 10\,\text{kHz}$$

Step 3: Conclusion.
Thus, the Nyquist rate is 10 kHz.

> **Quick Tip**
>
> Nyquist Rate $= 2 \times$ Maximum frequency $\rightarrow$ Prevents aliasing.

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2. How many flip-flops are required to build a MOD-16 counter?
(A) 2
(B) 3
(C) 4
(D) 5

Correct Answer: (3) 4

Solution:

Concept: A MOD-N counter requires a number of flip-flops such that:

$$N \leq 2^n$$

where n is the number of flip-flops.
Step 1: Given MOD value.

$$N = 16$$

Step 2: Find minimum n.

$$2^n \geq 16$$

$$2^4 = 16$$

Step 3: Conclusion.
Thus, 4 flip-flops are required.

> Quick Tip
>
> MOD-N counter $\rightarrow$ Flip-flops $= \log_2 N$ $\rightarrow$ For 16 $\rightarrow$ 4 flip-flops.

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3. Which type of power amplifier has the highest theoretical efficiency?
(A) Class A
(B) Class B
(C) Class AB
(D) Class C

Correct Answer: (4) Class C

Solution:

Concept: Power amplifiers are classified based on their conduction angle and efficiency. Efficiency refers to how much of the input power is converted into useful output power.
Step 1: Understanding amplifier classes.

- Class A: Conducts for full cycle (360°), low efficiency (25–30%)
- Class B: Conducts for half cycle (180°), moderate efficiency (78.5%)
- Class AB: Between Class A and B
- Class C: Conducts for less than 180°

Step 2: Efficiency comparison.
Class C amplifiers have the highest theoretical efficiency (can exceed 80–90%) because they conduct for a very small portion of the input cycle.

Step 3: Limitation.
They introduce significant distortion and are mainly used in RF applications where tuned circuits are employed.
Step 4: Conclusion.
Thus, Class C amplifiers have the highest theoretical efficiency.

> **Quick Tip**
>
> Efficiency order → Class C ¿ Class B ¿ Class AB ¿ Class A.

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4. 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: (3) 180°

Solution:

Concept: In transistor amplifier configurations, the phase relationship between input and output signals is an important characteristic.
Step 1: Understanding CE configuration.
In a Common Emitter configuration, the input is applied between base and emitter, and output is taken between collector and emitter.
Step 2: Phase relationship.
When the input signal increases, the collector current increases, causing a larger voltage drop across the collector resistor.
Step 3: Effect on output voltage.
This results in a decrease in output voltage, meaning the output signal is inverted relative to the input.
Step 4: Phase shift.
This inversion corresponds to a phase shift of:

$$180^\circ$$

Step 5: Conclusion.
Thus, the CE amplifier produces a 180° phase shift.

> **Quick Tip**
>
> Common Emitter → Output is inverted → Phase shift = 180°.

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5. What is the relationship between the bandwidth and the Q-factor in a resonant circuit?
(A) $Q = BW$
(B) $Q = \frac{f_0}{BW}$
(C) $Q = BW^2$
(D) $Q = \frac{BW}{f_0}$

Correct Answer: (2) $Q = \frac{f_0}{BW}$

Solution:

Concept: In a resonant circuit, the Quality factor (Q-factor) indicates how sharp or selective the resonance is. It relates the resonant frequency to the bandwidth.
Step 1: Understanding Q-factor.
Q-factor is defined as the ratio of resonant frequency (f_0) to the bandwidth (BW).
Step 2: Mathematical relation.

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

Step 3: Interpretation.

- High Q → Narrow bandwidth → Sharp resonance
- Low Q → Wide bandwidth → Broad response

Step 4: Conclusion.
Thus, Q-factor is inversely proportional to bandwidth.

Quick Tip

Q-factor ↑ → Bandwidth ↓ → $Q = \frac{f_0}{BW}$.

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6. 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: (3) $\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$

Solution:

Concept: Maxwell's equations describe the behavior of electric and magnetic fields. One of these equations represents Faraday's Law of Electromagnetic Induction.
Step 1: Understanding Faraday's Law.
Faraday's Law states that a changing magnetic field induces an electric field.
Step 2: Mathematical expression.

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

Step 3: Interpretation.

- Time-varying magnetic field produces a circulating electric field
- Basis of transformers, generators, and inductors

Step 4: Eliminating other options.

- (A): Gauss's Law (electric field)
- (B): Gauss's Law for magnetism
- (D): Ampere-Maxwell Law

Step 5: Conclusion.
Thus, $\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$ represents Faraday's Law.

Quick Tip

Faraday's Law → Changing magnetic field induces electric field → $\nabla \times E = -\frac{\partial B}{\partial t}$.

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7. 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: (2) Threshold voltage

Solution:

Concept: MOSFET operation regions depend on the relationship between gate-to-source voltage (V_{GS}), threshold voltage (V_{th}), and drain-to-source voltage (V_{DS}).
Step 1: Condition for conduction.
A MOSFET starts conducting when:

$$V_{GS} > V_{th}$$

Step 2: Condition for saturation region.
For saturation:

$$V_{GS} > V_{th} \quad \text{and} \quad V_{DS} \geq (V_{GS} - V_{th})$$

Step 3: Interpretation.
The key requirement is that the gate-to-source voltage must exceed the threshold voltage to form a conducting channel.
Step 4: Conclusion.
Thus, the MOSFET enters operation (and saturation condition builds upon it) when V_{GS} exceeds the threshold voltage.

> **Quick Tip**
>
> MOSFET ON condition $\rightarrow V_{GS} > V_{th} \rightarrow$ Required for saturation region.

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8. What is the Z-transform of a unit impulse function $\delta[n]$?
(A) z
(B) $\frac{1}{z}$
(C) 1
(D) $\frac{1}{1 - z^{-1}}$

Correct Answer: (3) 1

Solution:

Concept: The Z-transform of a discrete-time signal $x[n]$ is defined as:

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

Step 1: Unit impulse definition.

$$\delta[n] = \begin{cases} 1, & n = 0 \\ 0, & n \neq 0 \end{cases}$$

Step 2: Apply Z-transform.

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

Only $n = 0$ contributes:

$$X(z) = z^0 = 1$$

Step 3: Conclusion.
Thus, the Z-transform of $\delta[n]$ is 1.

Quick Tip

$\delta[n] \rightarrow$ Z-transform $= 1 \rightarrow$ Only value at $n = 0$ contributes.

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9. Which modulation technique is more immune to noise: AM or FM?
(A) AM
(B) FM
(C) Both equally
(D) None

Correct Answer: (2) FM

Solution:

Concept: Noise primarily affects the amplitude of signals in communication systems. Different modulation techniques respond differently to noise.
Step 1: Understanding AM.
In Amplitude Modulation (AM), information is carried by varying the amplitude of the carrier signal.
Step 2: Understanding FM.
In Frequency Modulation (FM), information is carried by varying the frequency, while amplitude remains constant.
Step 3: Effect of noise.

- Noise mainly affects amplitude
- AM signals are easily distorted by noise
- FM signals resist noise since amplitude variations are ignored

Step 4: Conclusion.
Thus, FM is more immune to noise compared to AM.

Quick Tip

FM $\rightarrow$ More noise resistant (amplitude unaffected); AM $\rightarrow$ Noise sensitive.

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10. In digital logic, what is the dual of the OR operation?
(A) NOT
(B) AND
(C) XOR
(D) NAND

Correct Answer: (2) AND

Solution:

Concept: In Boolean algebra, the principle of duality states that every algebraic expression remains valid if operators and identity elements are interchanged.
Step 1: Duality principle.
To find the dual:

- Replace OR (+) with AND (·)
- Replace AND (·) with OR (+)
- Replace 0 with 1 and 1 with 0

Step 2: Apply to OR operation.
The dual of OR is AND.
Step 3: Example.

$$A + B \quad \leftrightarrow \quad A \cdot B$$

Step 4: Conclusion.
Thus, the dual of the OR operation is AND.

Quick Tip

Duality → OR AND, 0 1.

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11. What is the characteristic impedance of a lossless transmission line?
(A) $\sqrt{\dfrac{R}{G}}$
(B) $\sqrt{\dfrac{L}{C}}$
(C) $\dfrac{R}{L}$
(D) $\dfrac{G}{C}$

Correct Answer: (2) $\sqrt{\dfrac{L}{C}}$

Solution:

Concept: A transmission line is characterized by primary constants: resistance (R), inductance (L), conductance (G), and capacitance (C). The characteristic impedance depends on these parameters.
Step 1: General formula.

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

Step 2: Lossless condition.
For a lossless line:

$$R = 0, \quad G = 0$$

Step 3: Simplified formula.

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

Step 4: Conclusion.

Thus, the characteristic impedance of a lossless transmission line is $\sqrt{\frac{L}{C}}$.

Quick Tip

Lossless line $\rightarrow R = 0, G = 0 \rightarrow Z_0 = \sqrt{\frac{L}{C}}$.

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12. Which theorem is used to find the maximum power transferred to a complex load?
(A) Thevenin's Theorem
(B) Norton's Theorem
(C) Superposition Theorem
(D) Maximum Power Transfer Theorem

Correct Answer: (4) Maximum Power Transfer Theorem

Solution:

Concept: Maximum power transfer occurs when the load impedance is properly matched with the source impedance.
Step 1: Condition for maximum power (AC circuits).
For complex loads:

$$Z_L = Z_S^*$$

(i.e., load impedance is the complex conjugate of source impedance)
Step 2: Relevant theorem.
This condition is derived from the **Maximum Power Transfer Theorem**.
Step 3: Importance.

- Used in communication systems
- Ensures efficient power delivery

Step 4: Eliminating other options.

- Thevenin/Norton: Simplify circuits

- Superposition: Analyzes multiple sources

Step 5: Conclusion.
Thus, Maximum Power Transfer Theorem is used.

Quick Tip

Max power $\rightarrow Z_L = Z_S^* \rightarrow$ Use Maximum Power Transfer Theorem.

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13. What is the CMRR (Common Mode Rejection Ratio) of an ideal Operational Amplifier?
(A) 0
(B) 1
(C) Infinite
(D) Very small

Correct Answer: (3) Infinite

Solution:

Concept: CMRR (Common Mode Rejection Ratio) is a measure of an operational amplifier's ability to reject common-mode signals (signals that are present simultaneously and in-phase on both inputs).
Step 1: Definition of CMRR.

$$\text{CMRR} = \frac{A_d}{A_c}$$

where:

- A_d = Differential gain
- A_c = Common-mode gain

Step 2: Ideal Op-Amp condition.
For an ideal operational amplifier:

- Differential gain (A_d) is infinite
- Common-mode gain (A_c) is zero

Step 3: Resulting CMRR.

$$\text{CMRR} = \frac{\infty}{0} = \infty$$

Step 4: Interpretation.
An infinite CMRR means the op-amp completely rejects common-mode signals and amplifies only the difference between inputs.
Step 5: Conclusion.
Thus, the CMRR of an ideal op-amp is infinite.

Quick Tip

Ideal Op-Amp $\rightarrow A_d = \infty$, $A_c = 0 \rightarrow$ CMRR $= \infty$.
