QUESTION BANK

Name of the Department : Electronics and Communication Engineering

Subject Code & Name : VL4151 & ANALOG IC DESIGN

Year & Semester : I & I (M.E-VLSI Design)

UNIT – I

SINGLE STAGE AMPLIFIERS

PART – A

1. Define MOS.

MOS stands for metal-oxide-semiconductor, and is a structure that is used to build transistors and capacitors

2. What is source follower?

A source follower, also known as a common drain amplifier, is a type of electronic circuit that acts as a voltage buffer. It's one of three basic single-stage field-effect transistor (FET) amplifier topologies.

3. Define differential amplifier.

A differential amplifier is a circuit that amplifies the difference between two input signals while rejecting common signals, like noise and interference that are present in both inputs. Differential amplifiers are often used in analog circuit design, especially in environments with a lot of electrical noise.

4. Define cascode amplifier.

A cascode amplifier is a single device that combines multiple amplifiers in a series to amplify an input signal. The output of each amplifier stage is connected to the input of the next stage.

5. What do you meant by gain?

The gain of an amplifier is the ratio of the output signal power or voltage to the input signal power or voltage. It's a key characteristic of an amplifier that determines how much a signal is amplified.

6. What is meant by ICMR?

ICMR stands for input common-mode range, which is the range of common-mode voltages at which a differential amplifier can continue to amplify and sense the difference signal with the same gain. It's typically defined as the range of common-mode voltages where all MOSFETs remain in the saturation region.

7. Define power dissipation.

Power dissipation is the process by which an electronic or electrical device produces heat as a result of its primary action. It's a natural process that occurs when electrical power is converted into heat energy.

8. What is voltage swing?

Voltage swing is when the voltage in a circuit either drops below normal operating levels or spikes, causing an unexpected surge into an appliance.

9. List the applications of analog IC.

Voltage and Current regulators: It is commonly used in power circuits where the output should remain constant irrespective of varying input voltage. The regulator IC ensures constant output. Voltage regulators are commonly used in all power supply systems.

10. What is single stage amplifier?

` When only one transistor associated with the circuit is used for amplification of a weak signal, the circuit is known as a single-stage amplifier.

11. Define active load.

An active load is a circuit component or source that can be used in a variety of applications.

PART – B

1. Explain on basic MOS physics with a neat diagram.
2. Write short notes on CS,CG and source follower.
3. Explain about design of differential amplifiers with neat sketch.
4. Describe about design of cascode amplifiers.
5. Write short notes on cascade and folded cascode configurations.

UNIT II

HIGH FREQUENCY AND NOISE CHARACTERISTICS OF AMPLIFIERS

PART – A

1. Define Miller effect.

The Miller effect is a phenomenon that occurs in MOSFETs and other electronic components that limits their switching speed and high-frequency gain

2. Define frequency response.

The frequency response of an amplifier is the range of frequencies it can operate at, and how its gain and phase shift change over that range.

3. What is association of poles with nodes?

The association of poles with nodes is a concept in circuit analysis that involves the poles of a circuit's transfer function and their role in the frequency response.

4. What is high frequency?

High frequency refers to electromagnetic waves with frequencies that are higher than other ranges.

5. Give the noise characteristics.

Frequency, Loudness, Amplitude, Perception and Pattern.

6. What is the purpose of source follower?

A source follower, also known as a common-drain amplifier, is a type of field-effect transistor (FET) amplifier circuit that acts as a voltage buffer. It's used to send signals from a high impedance source to a low impedance load.

7. What is meant by statistical characteristics of noise?

It includes RMS amplitude, Uncorrelated sources and small sources.

8. Define noise in single stage amplifiers.

Noise in single stage amplifiers is an unwanted signal that can degrade the quality of a signal. Noise can come from a variety of sources, including: KTC noise, Dark current noise, CCD amplifier noise, and Photonic noise.

9. What is meant by CS?

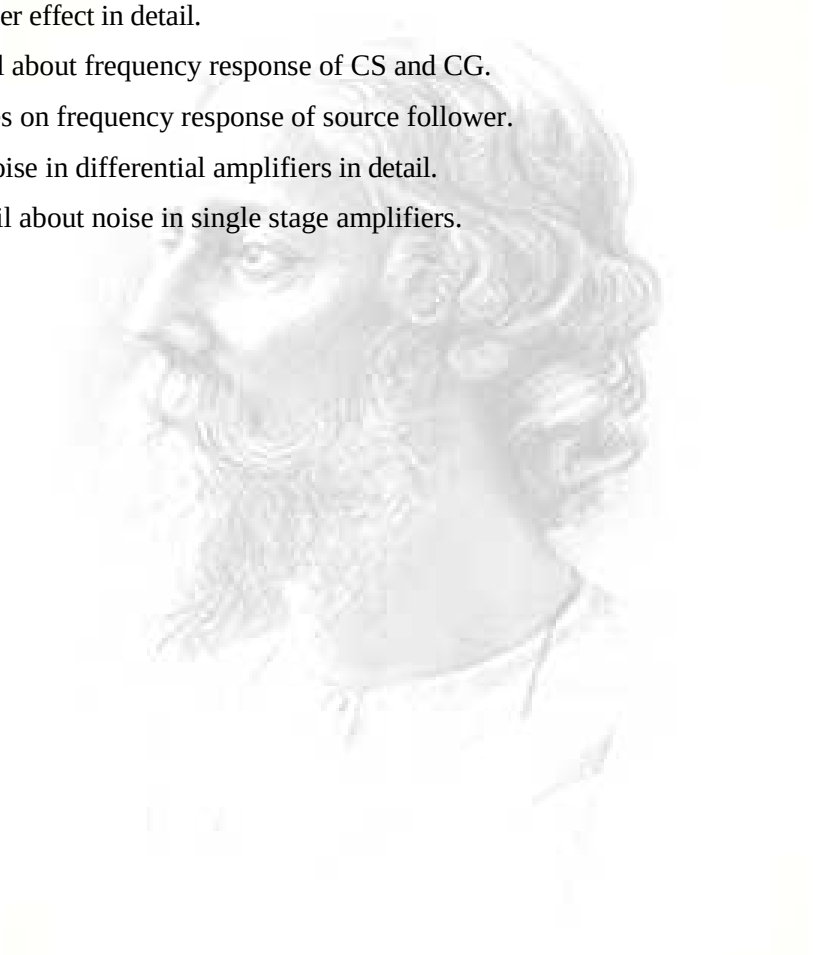
A common-source amplifier is a type of FET amplifier that's used as a voltage or transconductance amplifier. In a common-source amplifier, the input signal is applied to the gate and the output signal is taken from the drain.

10. List the noise in differential amplifiers.

Common-mode noise, Differential mode noise and Flicker noise and burst noise

PART – B

1. Explain on Miller effect in detail.
2. Discuss in detail about frequency response of CS and CG.
3. Write short notes on frequency response of source follower.
4. Explain about noise in differential amplifiers in detail.
5. Discuss in detail about noise in single stage amplifiers.



UNIT III

FEEDBACK AND SINGLE STAGE OPERATIONAL AMPLIFIERS

1. What is feedback?

Feedback means connecting the output back to the input. Typically, a feedback amplifier has two sections. They are the feedback circuit and the amplifier.

2. Define single stage OPAMP.

A single stage op amp is an amplifier that uses a single transistor or a pair of transistors to amplify a weak signal. It can be controlled by an external current called the bias current.

3. What is negative feedback circuit?

A negative feedback circuit is a circuit or mechanism where the output of a system is used to control or reduce its own activity. This is done by feeding back a signal that is opposite to the signal already present in the circuit.

4. Define feedback networks.

A feedback network in an amplifier is a linear two-port network that contains components like capacitors, inductors, and resistors. It's part of a feedback amplifier, which is an amplifier that uses some of its output to improve its input.

5. Write about OPAMP.

An operational amplifier is an integrated circuit that can amplify weak electric signals. An operational amplifier has two input pins and one output pin.

6. What is gain boosting?

Gain boosting is a technique that improves the accuracy of cascoded CMOS circuits without affecting speed. It does this by increasing the effect of the cascode transistor with an additional gain stage. This increases the output impedance of the subcircuit.

7. What is slew rate?

Slew rate is the maximum rate at which the output voltage of an operational amplifier (op-amp) can change over time. It is usually measured in volts per microsecond (V/µs), but some low-power op amps may use volts per millisecond (V/ms).

8. Define PSRR.

Power supply rejection ratio (PSRR) is a measure of how well an amplifier or circuit can reject noise and ripple in its power inputs. It's also known as the power supply sensitivity or supply-voltage rejection ratio (kSVR).

9. Define two stage OPAMP.

A two-stage operational amplifier (op-amp) is a high-performance analog signal processing device that amplifies weak input signals and transfers them to an output. It has two stages:

Differential amplifier: The input stage that amplifies the difference between the input signals. This stage determines the slew rate, CMRR, and other performance specifications.

Inverting amplifier: The second stage that provides a large voltage gain.

10. What is meant by noise in OPAMP?

Noise in an operational amplifier (op-amp) is a combination of white noise and 1/f noise, which can reduce the accuracy and sensitivity of a sensor.

PART – B

1.Describe the Properties and types of negative feedback circuits in detail.

2.Explain about effect of loading in feedback networks.

3.Discuss about operational amplifier performance parameters in detail.

4.Discuss on single stage Op Amps and two-stage Op Amps in detail.

5.Write short notes on input range limitations.

UNIT IV

STABILITY AND FREQUENCY COMPENSATION OF TWO STAGE AMPLIFIER

PART – A

1. What is stability?

Stability in an operational amplifier (op-amp) refers to the circuit's ability to avoid unwanted oscillations or ringing. It is determined by the phase margin, which is the difference between 180 degrees and the op-amp's phase shift at the frequency where the gain is 1.

2. What is frequency compensation?

Frequency compensation is a design technique that modifies the phase and gain characteristics of an amplifier's feedback network or open loop output to prevent oscillation. It's usually implemented using resistance-capacitance networks, either internally or externally.

3. What is two stage amplifier?

A two-stage amplifier is an electronic amplifier that's made by connecting two single-stage amplifiers together. This is done to increase the amplifier's gain, which is useful in applications where the input signal is very small, such as radio receivers.

4. What is phase margin?

Phase margin is a measurement of how much phase shift occurs when an amplifier's gain passes through 0 dB. It's a way to measure how close a system's second pole is to becoming unstable.

5. Write about multiple systems in two stage amplifier.

A multistage amplifier is an electronic amplifier that's made up of two or more single-stage amplifiers that are connected together.

6. What is Slewing in Two Stage Op Amps?

Slew rate is defined as the maximum rate of change of an op amps output voltage, and is given in units of volts per microsecond. Slew rate is measured by applying a large signal step, such as one volt, to the input of the op amp, and measuring the rate of change from 10% to 90% of the output signal's amplitude.

7. List the frequency compensation techniques.

Lead compensation, Lead-lag compensation, Feed-forward compensation, Miller compensation, Shunt capacitance compensation, Isolation resistor compensation, Dominant pole compensation and Gain compensation**.**

8. Define CMOS.

CMOS stands for Complementary Metal-Oxide-Semiconductor, a technology used in the manufacturing of computer processors, memory chips, and other digital devices. CMOS is a semiconductor technology that's used in most integrated circuits (ICs), also known as chips or microchips.

9. List applications of two stage amplifiers.

Two-stage amplifiers are commonly used in applications where a small input signal needs to be amplified, such as in radio receivers. Two-stage amplifiers are a type of multistage amplifier that can provide high gain and output swing.

10. Give applications of frequency compensation.

Communications, Radar signal processing, Power harmonics analysis, and Optical engineering.

PART – B

1.Describe on analysis Of Two Stage Op Amp in detail.

2.Discuss on Frequency Compensation.

3.Discuss about Frequency Compensation of Two Stage Op Amp in detail.

4.Explain in detail about Slewing In Two Stage Op Amps.

5. Write short notes on various frequency compensation techniques.

UNIT V

BANDGAP REFERENCES

PART – A

1. What is current sink?

Source current is the ability of the digital output/input port to supply current. Sink current is the ability of the port to receive current. When you have a simple circuit where a digital input connects to a digital output, you need three components; a voltage source, a ground, and a load.

2. What is current source?

A current source is an electronic circuit that supplies a constant electric current that's independent of the voltage across it. Current sources are used to power loads and are usually hidden inside electronic circuitry.

3. What is current mirrors?

A current mirror is a circuit that copies the current flowing through one device to another, keeping the output current constant even when the circuit is loaded. Current mirrors are used in analog and mixed VLSI circuits**.**

4. What is the need for Wilson current source?

The Wilson current source is used in applications that require a more accurate and stable current source or sink, such as those that are high-precision**.**

5. What is Widlar current source?

A Widlar current source is a modification of the basic two-transistor current mirror that incorporates an emitter degeneration resistor for only the output transistor, enabling the current source to generate low currents using only moderate resistor values.

6. Define cascode current source.

A cascode current source is a type of amplifier that's made up of two stages, and can be implemented using either bipolar junction transistors (BJTs) or field-effect transistors (FETs)**.**

7. Define current amplifiers.

A current amplifier is an electronic circuit that increases the magnitude of an input signal's current, while keeping the voltage component of the input signal unchanged. It's also known as a zero resistance amplifier (ZRA) because it produces a voltage output that's proportional to a current input.

8. What is CTAT current generation?

CTAT current generation is a process that produces a current that is complementary to absolute temperature. CTAT stands for complementary to absolute temperature. CTAT current generation circuits are a key component of curvature corrected bandgap reference circuits.

9. Define PTAT current generation .

PTAT (proportional to absolute temperature) current generation is a method of producing a current that is proportional to the absolute temperature.

10. Define constant-gm biasing.

Constant-gm biasing is a technique that helps transistors maintain a constant gm over a wide range of temperatures. It's a popular technique for high temperature compensation.

PART – B

1.Brief about current mirrors.

2.Explain on Current sinks and sources in detail.

3.Explain in detail supply independent biasing.

4.Describe on design of high swing cascode sink.

5.Explain about PTAT and CTAT current generation.