Lesson Plan No. 1	Course Name: Electronic Devices & Circuits Topic: Need of cascading for Single and Multistage Amplifiers	Course No.: ECE-301

Objectives	At the end of the lesson the student shall be able to: a. articulate the concept of cascading in amplifiers. b. illustrate differences between single-stage and multistage amplifiers c. describe the advantages and disadvantages of cascading amplifiers d. analyse the impact of cascading on amplifier performance
Teaching Aids (if any)	a. Chalk & Talk b. Presentation
Teaching Development	1. **Introduction** (5 minutes) - Ask questions. What is an amplifier? What are the limitations of using a single-stage amplifier? How might the performance of an amplifier be improved by connecting multiple stages in series? 2. **Development** (30 minutes) a. Single-Stage Amplifiers - Define single-stage amplifiers. - Explain the basic operation and components (transistors, resistors, capacitors). - Discuss the limitations in terms of gain and bandwidth. - Provide examples of common single-stage amplifier configurations b. Need for Cascading - Introduce the concept of cascading in amplifiers. - Explain how cascading improves gain and bandwidth. - Discuss the importance of impedance matching between stages to ensure optimal performance. c. Multistage Amplifiers - Define multistage amplifiers and how they are constructed by cascading single stages. - Describe different configurations (e.g., CE-CE, CE-CB, cascode). - Benefits of multistage amplifiers - Discuss the trade-offs involved in cascading, such as increased complexity and power consumption.

	3. Exercise (5 minutes) – - Numerical on gain and bandwidth calculations
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading - https://resources.system-analysis.cadence.com/blog/msa2021-build-practical-amplifiers-by-cascading-single-stage-transistor-amplifiers 3. Homework - Tabulate differences between single stage and multistage amplifiers Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, How?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 2	Course Name: Electronic Devices & Circuits Topic: Techniques for improving input resistance	Course No.: ECE-301

Objectives	At the end of the lesson the student shall be able to: a. articulate the concept of input resistance in amplifiers and its significance in circuit design. b. identify the impact of input resistance on amplifier performance. c. explain various techniques to improve input resistance in amplifiers.
Teaching Aids (if any)	a. Chalk & Talk b. Presentation
Teaching Development	1. **Introduction** (5 minutes) - Ask questions. Why do you think input resistance is a critical parameter in amplifier design? How might low input resistance affect the performance of an amplifier? Can anyone explain how input resistance relates to the impedance matching of a circuit? 2. **Development** (30 minutes) a. Understanding Input Resistance in Amplifiers - Define input resistance and explain its role in amplifier circuits. - Discuss the importance of high input resistance for minimizing signal loss and ensuring proper impedance matching. - Provide examples of common amplifier configurations and their typical input resistances. b. Impact of Input Resistance on Amplifier Performance - Explain how low input resistance can lead to loading effects, signal attenuation, and distortion. - Discuss the implications of input resistance on voltage gain and bandwidth. - Show practical examples where input resistance is a key design consideration. c. Techniques for Improving Input Resistance - Introduce the concept of bootstrapping - Introduce the concept of Darlington transistor

	3. Exercise (5 minutes) – Give numerical on calculation of input resistance in an amplifier circuit.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading - https://www.electronics-tutorials.ws/amplifier/input-impedance-of-an-amplifier.html 3. Homework - Assign problems requiring students to design amplifier circuits with specific input resistance requirements - Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, How?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 3	Course Name: Electronic Devices & Circuits Topic: Darlington Transistor	Course No.: ECE-301

Objectives	At the end of the lesson the student shall be able to: a. articulate the structure and working principle of a Darlington transistor b. explain the advantages and limitations of using Darlington transistors in electronic circuits c. analyse the performance characteristics of Darlington transistors, including current gain and input impedance.
Teaching Aids (if any)	a. Chalk & Talk b. Presentation
Teaching Development	1. **Introduction** (5 minutes) - Ask questions How can we improve input resistance of an amplifier circuit? How combining two transistors affects the overall performance of a circuit? 1. **Development** (30 minutes) a. Introduction to Darlington transistor - Define the Darlington transistor and explain its basic structure - Discuss the concept of high current gain in Darlington transistors and how it is achieved by cascading two transistors. - Illustrate the schematic symbol of a Darlington transistor and compare it with a single BJT. b. Working Principle of Darlington Transistor - Explain the operation of a Darlington transistor, focusing on the flow of current through the two transistors and the resulting high current gain. - Discuss the relationship between the input current, base current, and the output current, emphasizing the multiplicative effect on current gain. - Demonstrate the equivalent circuit of a Darlington pair and analyse its operation using simple circuit diagrams. c. Performance Characteristics and Analysis - Current gain - Input impedance - Voltage drop - Frequency response d. Applications of Darlington transistor

	- Provide examples of common applications where Darlington transistors are used - Discuss specific scenarios where the use of a Darlington pair is preferred over a single transistor. 2. Exercise (5 minutes) – Give numerical on calculation of different parameters of a Darlington circuit.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading - https://www.electronics-tutorials.ws/transistor/darlington-transistor.html 3. Homework - Prepare a table clearly depicting difference between simple BTJ and Darlington pair configurations. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, How?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 4	Course Name: Electronic Devices & Circuits Topic: Bootstrap emitter follower amplifiers	Course No.: ECE-301

Objectives	At the end of the lesson the student shall be able to: a. articulate the concept and operation of a bootstrap emitter follower amplifier b. explain the advantages of using bootstrap techniques to improve input impedance. c. analyse the circuit configuration and performance characteristics of bootstrap emitter follower amplifiers. d. design and implement a basic bootstrap emitter follower amplifier circuit.
Teaching Aids (if any)	a. Chalk & Talk b. Presentation
Teaching Development	2. **Introduction** (5 minutes) - Ask questions What are some challenges in designing amplifiers with high input impedance? How can feedback techniques be used to enhance amplifier performance? 3. **Development** (30 minutes) a. Introduction to Emitter Follower Amplifiers - Review the basic structure and operation of an emitter follower (common-collector) amplifier. - Discuss the typical characteristics of an emitter follower, including low output impedance, high input impedance, and unity voltage gain. - Explain the limitations of a standard emitter follower in achieving high input impedance. b. Concept of Bootstrapping - Introduce the bootstrapping technique as a method to increase the input impedance of a circuit. - Explain the basic idea behind bootstrapping: feeding a portion of the output signal back to the input in such a way that it "boosts" the input impedance. - Discuss how bootstrapping reduces the effective loading of the input by making the base resistor appear much larger. c. Bootstrap Emitter Follower Amplifier Circuit

	- Present the circuit diagram of a bootstrap emitter follower amplifier. - Explain the role of each component in the circuit: the transistor, the bootstrap capacitor, the feedback resistor, and the load. - Analyse the operation of the circuit, focusing on how the bootstrap capacitor feeds back a portion of the output signal to the base, thereby increasing the input impedance. d. Performance Analysis - High Input Impedance: Discuss how the bootstrapping technique significantly increases the input impedance compared to a standard emitter follower. - Voltage Gain: Explain that while the voltage gain remains close to unity, the main benefit of bootstrapping is in improving input impedance. - Frequency Response: Discuss the impact of the bootstrap capacitor on the frequency response of the amplifier, particularly in extending the bandwidth. 4. Exercise (5 minutes) – Give numerical on calculation of different parameters of a Bootstrap emitter follower circuit.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading - https://www.tutorialspoint.com/amplifiers/amplifiers_emitter_follower_and_darlington.htm 3. Homework - Prepare a comparative analysis of Darlington and bootstrap emitter follower conifgurations. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, How?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 5	Course Name: Electronic Devices & Circuits Topic: Method of coupling multistage amplifiers	Course No.: ECE-301

Objectives	At the end of the lesson the student shall be able to: a. Understand the need for coupling in multistage amplifiers. b. Explain the different coupling methods (Direct, RC, Transformer). c. Analyze the advantages, limitations, and applications of each coupling method. d. Evaluate the choice of coupling methods based on application requirements.
Teaching Aids (if any)	a. Chalk & Talk b. Presentation
Teaching Development	1. **Introduction** (5 minutes) - Ask questions Why is it necessary to connect multiple amplifier stages in real-world applications? What challenges might arise when transferring signals between stages in a multistage amplifier? How does the choice of coupling method impact the performance of an amplifier? 2. **Development** (30 minutes) a. Need for Coupling in Multistage Amplifiers - Discuss why single-stage amplifiers may not meet all requirements (e.g., gain, frequency response). - Explain the role of coupling in transferring signals: Ensures signal integrity. Matches impedances between stages. Blocks DC components (if needed). b. Types of Coupling - Direct Coupling Explanation: Connects the output of one stage directly to the input of the next stage. Advantages: Suitable for low-frequency and DC signals. Simple and cost-effective. Limitations: Sensitive to temperature and supply voltage variations (causing DC drift). Applications: Operational amplifiers, low-frequency signal amplification.

	Illustration: Show a simple circuit diagram of a direct-coupled amplifier. - RC Coupling Explanation: Uses a resistor-capacitor network to couple stages. Advantages: Blocks DC components while allowing AC signals to pass. Offers good frequency response for mid-band signals. Limitations: Inefficient for very low or high-frequency signals. Applications: Audio frequency amplifiers, communication circuits. Illustration: Show a circuit diagram of an RC-coupled amplifier. -Transformer Coupling Explanation: Employs a transformer to couple the stages, ensuring impedance matching. Advantages: High efficiency at radio frequencies. Effective impedance matching for power transfer. Limitations: Bulky, expensive, and limited frequency response. Applications: RF amplifiers, power amplifiers. 3. Exercise (5 minutes) – Compare different coupling techniques.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading - https://archive.nptel.ac.in/content/storage2/courses/115102014/downloads/unit4.pdf 3. Homework - Provide with circuit diagrams of each coupling method and ask them to identify the coupling components. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, How?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 6	Course Name: Electronic Devices & Circuits Topic: RC coupling	Course No.: ECE-301

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept and need for RC coupling in multistage amplifiers. b. Explain the working and components of an RC-coupled amplifier. c. Analyze the frequency response and performance of RC coupling. d. Identify applications and limitations of RC coupling in practical circuits.
Teaching Aids (if any)	a. Chalk & Talk b. Presentation
Teaching Development	1. **Introduction** (5 minutes) - Ask questions What challenges might arise when connecting multiple amplifier stages? How can RC coupling help maintain signal integrity while blocking unwanted components? Can you think of real-world applications where RC coupling is used (e.g., audio amplifiers)? 2. **Development** (30 minutes) a. Concept of RC Coupling - Definition: RC coupling is a method of connecting two amplifier stages using a resistor and capacitor network. - Purpose: To transfer AC signals from one stage to the next while blocking DC components. - Applications: Widely used in audio and communication amplifiers. b. Circuit Diagram and Components - Present a circuit diagram of an RC-coupled amplifier. - Explain the roles of key components: • Coupling Capacitor (C): Blocks DC while allowing AC signals to pass. Prevents the biasing of one stage from affecting the next stage. • Load Resistor (R): Provides a path for the AC signal. Helps maintain the desired operating point of the circuit. c. Working of RC-Coupled Amplifier - Input Stage: AC input signal is amplified by the first stage.

	- Coupling Network: Capacitor passes the AC component to the next stage while blocking DC. - Output Stage: Amplified AC signal appears at the output of the second stage. d. Frequency Response of RC Coupling -Low-Frequency Response: Limited by the coupling capacitor's reactance, which increases at low frequencies. - Mid-Frequency Response: High gain and stable response. - High-Frequency Response: Limited by parasitic capacitance and other factors. - Discuss how the values of the coupling capacitor and resistors affect the overall frequency response. e. Advantages and Limitations - Advantages: Simple and cost-effective. Provides good amplification for mid-band frequencies. - Limitations: Poor low-frequency response due to coupling capacitor limitations. Ineffective for very high-frequency applications. 3. Exercise (5 minutes) – Construct an RC-coupled amplifier using basic components
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading - https://www.tutorialspoint.com/amplifiers/rc_coupling_amplifier.htm 3. Homework - Give numerical on RC coupled amplifier Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, How?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 7	Course Name: Electronic Devices & Circuits Topic: DC coupling	Course No.: ECE-301

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept and purpose of DC coupling in multistage amplifiers. b. Explain the working and components of a DC-coupled amplifier. c. Analyze the advantages, limitations, and applications of DC coupling. d. Evaluate the performance of DC coupling in low-frequency and DC signal amplification.
Teaching Aids (if any)	a. Chalk & Talk b. Presentation
Teaching Development	1. **Introduction** (5 minutes) - Ask questions What types of signals (AC or DC) are most important in applications like instrumentation or operational amplifiers? Why might it be important to pass both AC and DC signals between amplifier stages? Can you think of scenarios where DC coupling would be more beneficial than RC coupling? 2. **Development** (30 minutes) a. Concept of DC Coupling - Definition: DC coupling directly connects the output of one amplifier stage to the input of the next without any intervening components like capacitors or transformers. - Purpose: Enables the transmission of both AC and DC components between stages. - Applications: Instrumentation amplifiers, operational amplifiers, low-frequency signal amplification. b. Circuit Diagram and Components - Present a circuit diagram of a DC-coupled amplifier. - Explain the roles of key components: Transistor or Operational Amplifier: Provides amplification. Resistors: Bias and stabilize the amplifier stages. c. Working of DC Coupling - Input Stage: Amplifies the signal and directly feeds it to the next stage.

	- Inter-stage Connection: No blocking elements like capacitors; DC bias levels are carried forward. - Output Stage: Amplified signal (both AC and DC components) appears at the output. d. Advantages and Limitations - Advantages: Transmits both AC and DC signals. Simple design without the need for coupling capacitors or transformers. Eliminates low-frequency limitations inherent in RC or transformer coupling. - Limitations: Prone to DC drift due to temperature variations and power supply fluctuations. Can result in distortion if biasing is not properly designed. 3. Exercise (5 minutes) – Construct an RC-coupled amplifier using basic components
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading - https://www.tutorialspoint.com/amplifiers/direct_coupled_amplifier.htm 3. Homework - Numerical on DC coupled amplifier Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, How?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 8	Course Name: Electronic Devices & Circuits Topic: Transformer coupling	Course No.: ECE-301

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept and purpose of transformer coupling in amplifiers. b. Explain the working and components of a transformer-coupled amplifier. c. Analyze the frequency response and performance of transformer coupling. d. Identify the advantages, limitations, and applications of transformer coupling.
Teaching Aids (if any)	a. Chalk & Talk b. Presentation
Teaching Development	1. **Introduction** (5 minutes) - Ask questions What challenges might arise in transferring signals between amplifier stages with different impedance levels? How do you think transformers help in matching impedances? Can you list real-world applications where transformer coupling might be beneficial (e.g., RF amplifiers, power amplifiers)? 2. **Development** (30 minutes) a. Concept of Transformer Coupling - Definition: Transformer coupling uses a transformer to connect the output of one amplifier stage to the input of the next. - Purpose: Provides impedance matching for efficient power transfer. Enables signal transmission over long distances without significant loss. - Applications: RF amplifiers, audio systems, and power amplifiers. b. Circuit Diagram and Components - Present a circuit diagram of a transformer-coupled amplifier. - Explain the roles of key components: Primary Winding: Connected to the output of the first stage. Secondary Winding: Connected to the input of the next stage. Core: Provides magnetic coupling between primary and secondary windings. c. Working of Transformer Coupling - Signal Transfer: AC signal in the primary winding induces a magnetic field in the core.

	Magnetic flux induces a corresponding signal in the secondary winding, transferring the signal to the next stage. - Impedance Matching: The transformer steps up or steps down impedance, depending on the turns ratio. - Isolation: Provides electrical isolation between stages, protecting sensitive components. d. Frequency Response - Low-Frequency Response: Limited by the inductance of the primary winding. Mid-Frequency Response: Optimal performance with minimal distortion. - High-Frequency Response: Limited by leakage inductance and interwinding capacitance. - Discuss how transformer characteristics (e.g., core material, winding design) affect frequency response. e. Advantages and Limitations - Advantages: Excellent impedance matching for efficient power transfer. Electrical isolation between stages. Effective for high-power and high-frequency applications. - Limitations: Expensive and bulky compared to RC coupling. Limited bandwidth due to transformer characteristics. Requires careful design to minimize distortion. 3. Exercise (5 minutes) – Construct an transformer-coupled amplifier using basic components
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading - https://www.tutorialspoint.com/amplifiers/transformer_coupled_amplifier.htm 3. Homework - Numerical on transformer coupled amplifier Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, How?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 9	Course Name: Electronic Devices & Circuits Topic: Frequency response of amplifiers	Course No.: ECE-301

Objectives	At the end of the lesson the student shall be able to: a. Understand the concept of frequency response in amplifiers. b. Explain the significance of bandwidth and cutoff frequencies. c. Analyze the low-frequency, mid-frequency, and high-frequency response of amplifiers. d. Evaluate the factors affecting frequency response and their implications in amplifier design.
Teaching Aids (if any)	a. Chalk & Talk b. Presentation
Teaching Development	1. **Introduction** (5 minutes) - Ask questions What is the importance of amplifying signals across a wide frequency range in applications like audio or radio systems? Have you observed how amplifiers might distort signals at very low or very high frequencies? Why is it important to analyze the performance of amplifiers across different frequency ranges? 2. **Development** (30 minutes) a. Concept of Frequency Response - Definition: Frequency response is the variation of an amplifier's gain with respect to the input signal frequency. - Purpose: To understand the range of frequencies over which the amplifier operates effectively. - Key Parameters: Cutoff Frequencies: Frequencies at which gain drops to 70.7% of its maximum value. Bandwidth: The range of frequencies over which the amplifier maintains nearly constant gain. Gain-Bandwidth Product: A figure of merit for amplifier performance. b. Frequency Response Regions - Low-Frequency Response: Dominated by coupling and bypass capacitors. Capacitors cause the gain to drop at low frequencies due to their reactance. Example: RC time constants affecting signal transmission. - Mid-Frequency Response:

	Gain remains approximately constant and unaffected by reactive components. Represents the amplifier's ideal operating range. - High-Frequency Response: Dominated by parasitic capacitances (e.g., transistor junction capacitances). Causes gain to drop due to the inability to maintain constant current flow at high frequencies. c. Factors Affecting Frequency Response - Internal Capacitance: Transistor junction capacitances and their impact on high-frequency roll-off. - Coupling and Bypass Capacitors: Influence on low-frequency response. - Parasitic Effects: Stray inductances and capacitances in the circuit layout. - Gain-Bandwidth Product: Trade-off between gain and bandwidth in amplifier design. d. Frequency Response Curve - Present a plot of a typical frequency response curve: - Label low, mid, and high-frequency regions. - Highlight cutoff frequencies, bandwidth, and gain characteristics. 3. Exercise (5 minutes) – Numerical on calculation of cut-off frequency
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading - https://www.electronics-lab.com/article/frequency-response-amplifiers/ 3. Homework - Simulate an amplifier and plot its frequency response in Multisim. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, How?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 10	Course Name: Electronic Devices & Circuits Topic: DC coupling	Course No.: ECE-301

Objectives	At the end of the lesson the student shall be able to: a. Understand the role of emitter capacitors in amplifier circuits. b. Analyze how emitter capacitors affect bandwidth and frequency response in cascaded amplifiers. c. Evaluate the trade-offs between bandwidth enhancement and low-frequency performance. d. Apply the concept of emitter capacitors in designing cascaded amplifiers for specific frequency ranges.
Teaching Aids (if any)	a. Chalk & Talk b. Presentation
Teaching Development	1. **Introduction** (5 minutes) - Ask questions Why are emitter capacitors often included in amplifier circuits? What is the relationship between bypass capacitors and frequency response? How might emitter capacitors influence cascaded amplifier performance? 2. **Development** (30 minutes) a. Role of Emitter Capacitors in Amplifiers - Definition: Emitter capacitors, also known as bypass capacitors, are connected in parallel with the emitter resistor to enhance gain at higher frequencies. - Purpose: Bypass AC signals to reduce the feedback effect of the emitter resistor. Increase the gain of the amplifier at mid and high frequencies. - Applications: Used in audio and communication amplifiers to achieve desired frequency responses. b. Effect on Frequency Response - Low Frequency Response: At low frequencies, the impedance of the emitter capacitor is high, and it behaves like an open circuit. Emitter resistor provides feedback, reducing gain. Larger emitter capacitors improve low-frequency response but may increase cost and size. - Mid Frequency Response: At mid-frequencies, the emitter capacitor bypasses the emitter resistor.

	Gain increases as the feedback effect of the emitter resistor is minimized. - High Frequency Response: At very high frequencies, parasitic capacitances and other factors limit the gain, regardless of the emitter capacitor's presence. c. Bandwidth Considerations - Definition of Bandwidth: The range of frequencies over which the amplifier operates effectively. - Impact of Emitter Capacitors: Improves mid-frequency gain, effectively widening the bandwidth. Proper selection of emitter capacitor values ensures adequate low-frequency response while maintaining a broad bandwidth. - Trade-offs: Larger emitter capacitors enhance low-frequency response but may introduce phase shifts or instability. Smaller emitter capacitors prioritize mid and high frequencies but limit low-frequency performance. d. Effect in Cascaded Amplifiers - Cascaded Amplifier Structure: Multiple amplifier stages connected in series to achieve higher overall gain. - Combined Frequency Response: The frequency response of cascaded amplifiers is influenced by the emitter capacitors in each stage. Proper design of emitter capacitors ensures that the bandwidth of individual stages aligns to achieve desired overall performance. - Challenges in Cascaded Amplifiers: Ensuring consistent frequency response across stages. Avoiding signal degradation at low frequencies due to small bypass capacitors. 3. Exercise (5 minutes) – Numerical on calculation of cut-off frequency
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading - https://www.sathyabama.ac.in/sites/default/files/course-material/2020-10/note_1474206600.pdf 3. Homework - Simulate an amplifier and plot its frequency response in Multisim with and without emitter capacitor. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, How?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 11	Course Name: Electronic Devices & Circuits Topic: Effect of bypass capacitors on the bandwidth of a cascaded amplifiers	Course No.: ECE-301

Objectives	At the end of the lesson the student shall be able to: a. Understand the role of bypass capacitors in amplifier circuits. b. Analyze how bypass capacitors influence the bandwidth in cascaded amplifiers. c. Evaluate the trade-offs in bypass capacitor selection for achieving desired frequency response. d. Apply design principles to optimize bandwidth in cascaded amplifier systems.
Teaching Aids (if any)	a. Chalk & Talk b. Presentation
Teaching Development	1. **Introduction** (5 minutes) - Ask questions What are the primary roles of bypass capacitors in amplifier circuits? Why is bandwidth an important parameter in amplifier design, especially in cascaded systems? How might bypass capacitors affect the gain and frequency response of an amplifier? 2. **Development** (30 minutes) a. Role of Bypass Capacitors in Amplifiers - Definition: Bypass capacitors are placed in parallel with emitter or source resistors to bypass AC signals, preventing them from being affected by feedback. - Purpose: Enhance the gain of the amplifier at mid and high frequencies. Improve the overall frequency response. - Applications: Widely used in audio, RF, and communication amplifiers to optimize gain and bandwidth. b. Impact of Bypass Capacitors on Frequency Response - Low Frequency Response: At low frequencies, the bypass capacitor's reactance is high, reducing its ability to bypass AC signals. Gain is lower due to the feedback introduced by the unbypassed resistor. Larger capacitors improve low-frequency performance by reducing reactance. - Mid Frequency Response:

	Bypass capacitors effectively short-circuit the emitter or source resistor for AC signals. Maximum gain is achieved as the feedback effect is minimized. - High Frequency Response: Parasitic capacitances and layout effects dominate. Bypass capacitors do not significantly affect the high-frequency roll-off. c. Bandwidth in Cascaded Amplifiers - Definition of Bandwidth: The range of frequencies over which the amplifier maintains consistent performance. - Effect of Bypass Capacitors: In cascaded amplifiers, the bandwidth is determined by the combined frequency responses of individual stages. Properly selected bypass capacitors ensure that each stage contributes effectively to the overall bandwidth. - Challenges: Overly large bypass capacitors may introduce phase shifts and instability. Inadequate bypassing reduces gain and narrows the bandwidth. d. Trade-offs in Bypass Capacitor Selection - Larger capacitors: Improve low-frequency response. Increase cost and size. May cause phase shift issues. - Smaller capacitors: Favor mid and high frequencies. Limit low-frequency performance. e. Practical Considerations in Cascaded Amplifiers - Aligning the frequency response of individual stages to achieve desired overall bandwidth. - Ensuring bypass capacitors in each stage are appropriately sized to prevent bottlenecks in the signal path. 3. Exercise (5 minutes) – Numerical on calculation of cut-off frequency
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading https://www.sathyabama.ac.in/sites/default/files/course-material/2020-10/note_1474206600.pdf 3. Homework Simulate an amplifier and plot its frequency response in Multisim with and without bypass capacitor. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, How?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 12	Course Name: Electronic Devices & Circuits Topic: Effect of emitter and bypass capacitors on the frequency response of a cascaded amplifiers	Course No.: ECE-301

Objectives	At the end of the lesson the student shall be able to: a. Understand the roles of emitter and bypass capacitors in amplifier circuits. b. Analyze how these capacitors influence the frequency response in cascaded amplifier systems. c. Evaluate the trade-offs between gain, bandwidth, and stability due to emitter and bypass capacitors. d. Apply design principles to optimize frequency response in cascaded amplifiers using emitter and bypass capacitors.
Teaching Aids (if any)	a. Chalk & Talk b. Presentation
Teaching Development	1. **Introduction** (5 minutes) - Ask questions What is the significance of emitter and bypass capacitors in amplifier design? How do emitter capacitors improve gain and frequency response? What are the challenges of designing cascaded amplifiers with multiple capacitors? 2. **Development** (30 minutes) a. Role of Emitter and Bypass Capacitors - Emitter Capacitors: Connected across the emitter resistor to bypass AC signals. Reduce negative feedback at AC frequencies, thereby improving gain and bandwidth. - Bypass Capacitors: Used to bypass emitter resistors or decouple power supplies, reducing AC feedback and stabilizing the circuit. b. Impact on Frequency Response - Low Frequency Response: Capacitors have high reactance at low frequencies, limiting their bypassing ability. Gain decreases at low frequencies due to the feedback effect of unbypassed emitter resistors. Larger capacitors reduce the cutoff frequency and improve low-frequency performance. - Mid Frequency Response:

	Both emitter and bypass capacitors effectively short-circuit AC signals. Gain is maximized, and the frequency response is stable within the mid-band range. - High Frequency Response: Parasitic capacitances dominate. The effect of emitter and bypass capacitors diminishes at high frequencies due to limitations in transistor and circuit parasitics. c. Frequency Response in Cascaded Amplifiers - Combined Frequency Response: Each stage contributes to the overall bandwidth and gain of the cascaded system. Properly designed emitter and bypass capacitors ensure that each stage operates within the desired frequency range. - Challenges: Misalignment in capacitor values across stages can narrow the overall bandwidth. Stability issues can arise if capacitors are too large or improperly placed. d. Trade-offs in Design - Larger Capacitors: Enhance low-frequency response but may increase size, cost, and phase shift issues. - Smaller Capacitors: Prioritize mid and high frequencies but limit low-frequency performance. - Balance in Cascaded Amplifiers: Capacitor values must align with the gain and bandwidth requirements of the system. e. Practical Considerations - Emitter Capacitors: Focus on improving mid-band gain and low-frequency response. - Bypass Capacitors: Used for decoupling and stabilizing AC signals across multiple stages. 3. Exercise (5 minutes) – Numerical of effect of these capacitors on cut-off frequencies
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading - https://www.sathyabama.ac.in/sites/default/files/course-material/2020-10/note_1474206600.pdf 3. Homework - Numerical on DC coupled amplifier Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, How?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents