Lesson Plan No. 31	Course Name: Basic Electrical & Electronics Engineering Topic: Principle and Operation of NPN Transistor	Course No.: ECE-201

Objectives	At the end of the lesson the student shall be able to:
	   a) Understand the principle of operation of an NPN transistor.
	   b) Illustrate the working of an NPN transistor with examples.
	   c) Appreciate the importance and applications of NPN transistors.

Teaching Aids (if any)	a) PowerPoint presentation b) Chalk and Talk

Teaching Development	**1. Introduction (5 minutes)**
	   - Ask questions.
	   - What are the basic components of a transistor?
	   - How do electrons and holes contribute to the working of a transistor?
	Introduce the concept of NPN transistors:
	   - Explain the structure and doping levels.
	   - Highlight the movement of electrons and holes.
	   - Need for transistors in modern circuits.
	
	2. Development (30 minutes)
	   a) Basic Structure and Principle of Operation
	   - Discuss the emitter, base, and collector regions.
	   - Illustrate the flow of current and the role of minority and majority carriers.
	   b) Operation in Different Modes
	   - Active mode: Explain the biasing of the emitter-base and collector-base junctions.
	   - Saturation mode
	   - Cut-off mode
	   - Discuss how the transistor switches between these modes.
	   c) Applications
	   - Amplification
	   - Switching
	   - Introduce simple circuits using NPN transistors.
	   d) Advantages and Disadvantages
	   - High speed
	   - Low cost
	   - Sensitivity to temperature variations
	3. Exercise (5 minutes)
	   - Provide numerical problems related to transistor currents and voltages.
	   - Examples of small signal amplification circuits.

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students. 2. Suggested Reading: Chapters on transistors from Millman-Halkias. 3. Homework: Solve numerical problems provided in class.

| Evaluation | 1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.

Spend 5 minutes to evaluate student assimilation of the lesson contents. |
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Lesson Plan No. 32	**Course Name: Basic Electrical & Electronics Engineering** **Topic:** Configuration and Characteristics (CB, CE, and CC)	**Course No.: ECE-201**

Objectives	At the end of the lesson the student shall be able to: (a) Differentiate between Common Base (CB), Common Emitter (CE), and Common Collector (CC) configurations. (b) Analyze the input and output characteristics of each configuration. (c) Understand the applications of each configuration.
Teaching Aids (if any)	a. PowerPoint presentation b. Chalk and Talk

Teaching Development	**1. Introduction (5 minutes)**
	   - Ask questions.
	   - What is a transistor configuration?
	   - Why are different configurations used?
	   - Introduce the concept of transistor configurations:
	   - Highlight CB, CE, and CC configurations.
	   - Discuss the importance of different configurations in circuits.
	
	2. Development (30 minutes)
	  a. Common Base (CB) Configuration
	    - Explain the input and output characteristics.
	    - Illustrate the configuration with circuit diagrams.
	    - Discuss the high voltage gain and low input impedance.
	    - Provide examples of applications.
	  b. Common Emitter (CE) Configuration
	    - Discuss the input and output characteristics.
	    - Show circuit diagrams and explain current gain.
	    - Highlight the importance of CE configuration in amplification.
	    - Provide practical examples.
	  c. Common Collector (CC) Configuration
	    - Describe the input and output characteristics.
	    - Use circuit diagrams to explain voltage gain.
	    - Discuss applications like impedance matching.
	    - Give real-world examples.
	  d. Comparison and Applications
	    - Compare CB, CE, and CC configurations.
	    - Discuss the suitability of each configuration for different applications.

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	3. Exercise (5 minutes)
	   - Provide numerical problems related to each configuration.
	   - Examples of practical circuits using CB, CE, and CC configurations.

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students. 2. Suggested Reading: Transistor characteristics from Boylestad. 3. Homework: Solve numerical problems provided in class.
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 33	**Course Name: Basic Electrical & Electronics Engineering** **Topic:** Types of Biasing Circuit	**Course No.: ECE-201**

Objectives	At the end of the lesson the student shall be able to:
	   a) Understand different types of transistor biasing circuits.
	   b) Analyze the stability of each biasing method.
	   c) Appreciate the importance of proper biasing in transistor operation.

Teaching Aids (if any)	a) PowerPoint presentation b) Chalk and Talk

Teaching Development	**1. Introduction (5 minutes)**
	   - Ask questions.
	   - What is transistor biasing?
	   - Why is biasing necessary?
	Introduce the concept of biasing circuits:
	   - Discuss the purpose and need for biasing.
	   - Highlight the role of biasing in stable transistor operation.
	
	2. Development (30 minutes)
	   a) Fixed Bias
	   - Explain the fixed bias circuit and its operation.
	   - Discuss the advantages and disadvantages.
	   - Provide practical examples.
	   b) Collector-to-Base Bias
	   - Illustrate the circuit and operation.
	   - Explain the impact on stability and thermal runaway.
	   - Examples of applications.
	   c) Voltage Divider Bias
	   - Discuss the circuit and its advantages.
	   - Explain the improved stability and reduced sensitivity to variations.
	   - Provide practical examples.
	   d) Emitter Bias
	   - Describe the circuit and operation.
	   - Highlight the stability and common applications.

	- Real-world examples.
	e) Comparison and Analysis
	- Compare the different biasing methods.
	- Discuss the suitability for various applications.
	3. Exercise (5 minutes)
	1. Provide numerical problems related to each biasing method.
	2. Examples of biasing in practical circuits.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students.
	2. Suggested Reading: Biasing methods from Sedra/Smith.
	3. Homework: Solve numerical problems provided in class.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	Spend 5 minutes to evaluate student assimilation of the lesson contents.

| **Lesson Plan No. 34** | **Course Name: Basic Electrical & Electronics Engineering**
Topic: Hybrid Parameters Introduction | **Course No.: ECE-201** |

Objectives	At the end of the lesson the student shall be able to: a) Understand the concept of hybrid parameters. b) Explain the significance of h-parameters in transistor analysis. c) Apply h-parameters in solving transistor circuit problems.
Teaching Aids (if any)	a) PowerPoint presentation b) Chalk and Talk
Teaching Development	**1. Introduction (5 minutes)** - Ask questions - What are parameters in electrical circuits? - Why do we need to simplify transistor analysis? Introduce the concept of hybrid parameters: - Discuss the need for h-parameters. - Highlight the advantages of using h-parameters in circuit analysis. **2. Development (30 minutes)** a) Definition and Representation - Explain the definition of h-parameters. - Discuss the representation of h-parameters in matrix form. - Provide examples of h-parameter matrices. b) Calculation of h-Parameters - Explain how to calculate h-parameters for a given transistor. - Discuss the significance of each parameter (h_{11}, h_{12}, h_{21}, h_{22}). - Provide numerical examples. c) Application in Circuit Analysis

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	- Illustrate the use of h-parameters in analyzing transistor circuits.
	- Solve example problems using h-parameters.
	- Discuss the impact on input and output impedance.
	d) Advantages and Limitations
	- Simplification of complex circuits
	- Usefulness in small signal analysis
	- Limitations in high-frequency analysis
	3. Exercise (5 minutes)
	- Provide numerical problems related to h-parameter calculation.
	- Examples of circuit analysis using h-parameters.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students.
	2. Suggested Reading: h-parameter analysis from Boylestad.
	3. Homework: Solve numerical problems provided in class.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 35	**Course Name: Basic Electrical & Electronics Engineering** **Topic:** Two Port Networks	**Course No.: ECE-201**

Objectives	At the end of the lesson the student shall be able to:
	a) Understand the concept of two-port networks.
	b) Analyze the parameters and characteristics of two-port networks.
	c) Apply two-port network theory to solve electrical circuit problems.
Teaching Aids (if any)	a) PowerPoint presentation
	b) Chalk and Talk
Teaching Development	**1. Introduction (5 minutes)**
	- Ask questions:
	- What is a network in electrical engineering?
	- Why do we use two-port networks?
	Introduce the concept of two-port networks:
	- Discuss the significance in simplifying complex circuits.
	- Highlight the applications of two-port networks.
	2. Development (30 minutes)
	a) Definition and Parameters
	- Explain the definition of a two-port network.
	- Discuss the different parameters (Z, Y, H, ABCD).
	- Provide examples of each parameter type.
	b) Impedance (Z) Parameters
	- Discuss the Z parameters and their calculation.
	- Provide numerical examples and applications.
	c) Admittance (Y) Parameters
	- Explain the Y parameters and their significance.
	- Solve example problems using Y parameters.
	d) Hybrid (H) Parameters

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	- Discuss the H parameters and their use in transistor circuits.
	- Provide practical examples and problems.
	e) Transmission (ABCD) Parameters
	   - Explain the ABCD parameters and their application in network analysis.
	   - Solve numerical examples using ABCD parameters.
	f) Comparison and Applications
	   - Compare the different parameters.
	   - Discuss their suitability for various applications.
	
	3. Exercise (5 minutes)
	   - Provide numerical problems related to each parameter type.
	   - Examples of practical circuit analysis using two-port networks.

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students. 2. Suggested Reading: Two-port network analysis from Hayt/Kemmerly. 3. Homework: Solve numerical problems provided in class.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 36	Course Name: Basic Electrical & Electronics Engineering Topic: Hybrid Model for CE, CC, CB Configuration and Their Analysis Using H-Parameters	Course No.: ECE-201

Objectives	At the end of the lesson the student shall be able to: a) Understand the hybrid model for CE, CC, and CB configurations. b) Analyze transistor circuits using h-parameters. c) Apply h-parameter analysis to practical problems.
Teaching Aids (if any)	a) PowerPoint presentation b) Chalk and Talk

Teaching Development	**1. Introduction (5 minutes)**
	   - Ask questions:
	   - What are hybrid parameters?
	   - How are they used in transistor analysis?
	Introduce the hybrid model:
	   - Discuss the significance of using hybrid models.
	   - Highlight the benefits of h-parameter analysis.
	
	2. Development (30 minutes)
	a) Hybrid Model for CE Configuration
	   - Explain the hybrid model for the CE configuration.
	   - Discuss the h-parameter equations.
	   - Provide examples and solve numerical problems.
	b) Hybrid Model for CC Configuration
	   - Discuss the hybrid model for the CC configuration.

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	- Illustrate the h-parameter equations.
	- Solve example problems using CC configuration.
	c) Hybrid Model for CB Configuration
	- Explain the hybrid model for the CB configuration.
	- Discuss the h-parameter equations.
	- Provide practical examples and problems.
	d) Comparison and Applications
	- Compare the hybrid models for CE, CC, and CB configurations.
	- Discuss the applications of each configuration.
	3. Exercise (5 minutes)
	- Provide numerical problems related to h-parameter analysis.
	- Examples of circuit analysis using hybrid models.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students.
	2. Suggested Reading: Hybrid model analysis from Boylestad.
	3. Homework: Solve numerical problems provided in class.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 37	Course Name: Basic Electrical & Electronics Engineering **Topic:** Miller Theorem	Course No.: ECE-201

Objectives	At the end of the lesson the student shall be able to:
	a) Understand Miller Theorem and its significance in circuit analysis.
	b) Apply Miller Theorem to simplify complex circuits.
	c) Appreciate the practical applications of Miller Theorem.
Teaching Aids (if any)	a) PowerPoint presentation
	b) Chalk and Talk
Teaching Development	**1. Introduction (5 minutes)**
	- Ask questions:
	- What is the importance of simplifying circuits?
	- How do we handle feedback in circuits?
	Introduce Miller Theorem:
	- Discuss the concept and need for Miller Theorem.
	- Highlight the advantages of using Miller Theorem in circuit analysis.
	2. Development (30 minutes)
	a) Explanation of Miller Theorem
	- Define Miller Theorem and its mathematical formulation.
	- Discuss the application in voltage gain and impedance calculations.
	- Provide numerical examples.
	b) Application in Feedback Circuits
	- Explain the impact of feedback on impedance.

	- Illustrate examples of feedback circuits simplified using Miller Theorem.
	c) Examples and Numerical Problems
	- Provide step-by-step examples of circuit simplification using Miller Theorem.
	- Solve numerical problems involving impedance and gain calculations.
	d) Advantages and Limitations
	- Discuss the benefits of Miller Theorem in simplifying analysis.
	- Highlight the limitations and cases where Miller Theorem is not applicable.
	3. Exercise (5 minutes)
	- Provide numerical problems related to Miller Theorem.
	- Examples of practical circuits simplified using Miller Theorem.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students.
	2. Suggested Reading: Miller Theorem applications from Sedra/Smith.
	3. 1Homework: Solve numerical problems provided in class.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 38	Course Name: Basic Electrical & Electronics Engineering Topic: Principle of Operation and Characteristics of JFET	Course No.: ECE-201

Objectives	At the end of the lesson the student shall be able to: a) Understand the principle of operation of JFETs. b) Analyze the characteristics of JFETs. c) Appreciate the applications of JFETs in electronic circuits.
Teaching Aids (if any)	a) PowerPoint presentation b) Chalk and Talk
Teaching Development	**1. Introduction (5 minutes)** - Ask questions: - What are the basic components of a Field Effect Transistor (FET)? - How do JFETs differ from BJTs? Introduce the concept of JFETs: - Explain the structure and working principle. - Highlight the importance of JFETs in modern electronics. **2. Development (30 minutes)** a) Structure and Operation - Explain the structure of N-channel and P-channel JFETs. - Discuss the operation of JFETs in different regions (ohmic, active, pinch-off). - Provide practical examples.

	b) Characteristics of JFETs - Discuss the transfer and output characteristics. - Explain the impact of gate-source voltage on drain current. - Provide numerical examples and problems. c) Biasing of JFETs - Explain different biasing techniques (fixed bias, self-bias, voltage-divider bias). - Provide examples and solve numerical problems. d) Applications of JFETs - Discuss the use of JFETs in amplifiers, switches, and analog circuits. - Provide practical examples of JFET circuits. e) Advantages and Disadvantages - Highlight the high input impedance and low noise characteristics. - Discuss the limitations of JFETs compared to other transistors. **3. Exercise (5 minutes)** - Provide numerical problems related to JFET characteristics and biasing. - Examples of practical circuits using JFETs.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students. 2. Suggested Reading: JFET analysis from Millman-Halkias. 3. Homework: Solve numerical problems provided in class.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 39	Course Name: Basic Electrical & Electronics Engineering Topic: Biasing of FET	Course No.: ECE-201

Objectives	At the end of the lesson the student shall be able to: a) Understand different methods of biasing FETs. b) Analyze the stability of each biasing method. c) Appreciate the importance of proper biasing in FET operation.
Teaching Aids (if any)	a) PowerPoint presentation b) Chalk and Talk
Teaching Development	**1. Introduction (5 minutes)** - Ask questions: - What is FET biasing? - Why is biasing necessary for FETs? Introduce the concept of FET biasing circuits: - Discuss the purpose and need for biasing. - Highlight the role of biasing in stable FET operation. **2. Development (30 minutes)** a) Fixed Bias

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- Explain the fixed bias circuit and its operation.
- Discuss the advantages and disadvantages.
- Provide practical examples.
  b) Self-Bias
- Illustrate the circuit and operation.
- Explain the impact on stability and thermal runaway.
- Examples of applications.
  c) Voltage Divider Bias
- Discuss the circuit and its advantages.
- Explain the improved stability and reduced sensitivity to variations.
- Provide practical examples.
  d) Source Bias
- Describe the circuit and operation.
- Highlight the stability and common applications.
- Real-world examples.
  e) Comparison and Analysis
- Compare the different biasing methods.
- Discuss the suitability for various applications.

3. **Exercise (5 minutes)**
   - Provide numerical problems related to each biasing method.
   - Examples of biasing in practical circuits.

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students. 2. Suggested Reading: Biasing methods for FETs from Sedra/Smith. 3. Homework: Solve numerical problems provided in class.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents.

Lesson Plan No. 40	Course Name: Basic Electrical & Electronics Engineering Topic: MOSFET and CMOS	Course No.: ECE-201

Objectives	At the end of the lesson the student shall be able to:
	  a) Understand the principle of operation of MOSFETs and CMOS.
	  b) Analyze the characteristics and applications of MOSFETs and CMOS.
	  c) Appreciate the advantages of CMOS technology in modern electronics.

Teaching Aids (if any)	a) PowerPoint presentation b) Chalk and Talk

Teaching Development	1. **Introduction (5 minutes)**
	  - Ask questions:
	  - What are the basic components of a MOSFET?
	  - How do MOSFETs differ from JFETs?
	  Introduce the concept of MOSFETs and CMOS:

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	- Explain the structure and working principle of MOSFETs.
	- Highlight the importance of CMOS technology in modern electronics.
	2. Development (30 minutes)
	a) Structure and Operation of MOSFETs
	- Explain the structure of enhancement and depletion mode MOSFETs.
	- Discuss the operation of MOSFETs in different regions (cutoff, triode, saturation).
	- Provide practical examples.
	b) Characteristics of MOSFETs
	- Discuss the transfer and output characteristics.
	- Explain the impact of gate-source voltage on drain current.
	- Provide numerical examples and problems.
	c) CMOS Technology
	- Explain the structure and operation of CMOS.
	- Discuss the complementary nature of NMOS and PMOS transistors in CMOS.
	- Provide practical examples and problems.
	d) Applications of MOSFETs and CMOS
	- Discuss the use of MOSFETs in amplifiers, switches, and digital circuits.
	- Explain the advantages of CMOS in low power and high-speed applications.
	- Provide practical examples of MOSFET and CMOS circuits.
	e) Advantages and Disadvantages
	- Highlight the high input impedance and low power consumption of MOSFETs and CMOS.
	- Discuss the limitations compared to other transistors.
	3. Exercise (5 minutes)
	- Provide numerical problems related to MOSFET and CMOS characteristics and applications.
	- Examples of practical circuits using MOSFETs and CMOS.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students.
	2. Suggested Reading: MOSFET and CMOS analysis from Millman-Halkias.
	3. Homework: Solve numerical problems provided in class.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	Spend 5 minutes to evaluate student assimilation of the lesson contents