Lesson Plan No. 1	Course Name: Microwave Devices and Systems	Course No.: ECE-503

Objectives	At the end of the lesson the student shall be able to: a. Understand the basic concepts of microwave devices and their applications. b. Recognize the importance of microwave technology in modern communication systems. c. Identify various career opportunities in the field of microwave engineering.
Teaching Aids (if any)	a. Power point presentation b. You Tube video
Teaching Development	1. **Introduction** (10 minutes) • Ask questions: 1. When you use a microwave oven or a satellite TV, how do these devices operate? 2. How do microwave signals differ from other types of electromagnetic waves? 3. What are the advantages of using microwave technology in communication systems? 4. What role do microwaves play in modern radar systems? • Discuss the concept of microwave devices, explaining that microwaves are a subset of the electromagnetic spectrum with frequencies ranging from 1 GHz to 300 GHz. These are crucial in various fields like communication, medicine, and defense. • Explain the importance of studying microwave devices and systems, highlighting their role in the advancement of technology and society. • Discuss course outcomes. 2. **Development** (30 minutes) **Why Microwave Technology?** - Discuss the importance of microwave technology in today's digital age, particularly in communication systems (e.g., satellite communication, radar systems, and wireless networks). - Benefits such as high-speed data transmission, compactness of microwave circuits, and their applications in various fields. **Video Presentation:** Show a video on Microwave Devices and their applications: YouTube Video: "Introduction to Microwave Devices and Applications" by Steve Ellingson (https://www.youtube.com/watch?v=A9SNdF7UP18) **Career & Job Perspective** - Microwave Engineer, RF Engineer, Antenna Designer, and Communication Systems Engineer. - Discussion on certifications: • Certified Wireless Network Professional (CWNP) • Certified Microwave Technology Professional (CMTP)

	• IEEE Wireless Communications Professional (IEEE WCP) - Introduction to online courses available on platforms like edX and Coursera. **Future Trends in Networking** (10 minutes) - Real-time examples and emerging technologies: • 5G Technology and its reliance on microwave frequencies • Millimeter-wave technology in automotive radar systems • Microwave photonics for high-speed data transmission • Advances in microwave imaging for medical applications - Discuss how these trends are shaping the future of technology and job opportunities.
Closure	1. Summarize the lesson, correlating with learning outcomes 2. Encourage students to explore further reading and online resources **Suggested Reading:** "Microwave Engineering" by David M. Pozar, Chapter 1, pp 1-40. "Foundations for Microwave Engineering" by Robert E. Collin, Chapter 1, pp 1-30.
Evaluation	Reflective Questions (What Why Who?). Allow students to answer and discuss. 1. What are microwave devices, and why are they important in modern communication systems? 2. Can you think of some everyday applications that rely on microwave technology? 3. Which career roles in microwave engineering interest you the most, and why? Spend 5 minutes to wrap up and consolidate the learnings

Lesson Plan No. 2	Course Name: Microwave Devices & Systems Topic: Circuit model for transmission lines	Course No.: ECE-503

Objectives	At the end of the lesson the student shall be able to: a. Comprehend the basics of Transmission Lines b. Equivalent circuit model of Transmission Lines
Teaching Aids (if any)	a. Power point presentation
Teaching Development	1. **Introduction** (5 minutes) Ask questions - What are the microwaves? - What are the possible ways to transmit a signal? - Have you seen transmission lines? Introduce the concept of Transmission lines: - Talk about the concept. - Introduce the formal definition of using examples - Highlight the important of such transmission. 2. **Development** (30 minutes) a. Properties of microwave. - Definition and Overview. - Frequency Range and Wavelength. - Sources of Microwaves (Natural and Artificial). b. Technological Applications of Microwaves. - Communication Systems. - Satellite Communication. - Wireless Networks. - Radar Technology. - Microwave Ovens. - Medical Applications. c. Basic Transmission Line. - Introduction to Transmission Lines. - Types of Transmission Lines. - Transmission Line Parameters. d. Concept of equivalent circuit in transmission line. - Short transmission lines. - Medium transmission lines. - Long transmission lines. - Characteristic Impedance and Propagation Constant. **3. Exercise (5 minutes)** - Comprehend the Basics of Transmission Lines With two nodes. - Comprehend the basics of Transmission Lines

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested reading: - Transmission Lines from K. D. Prasad - Introduction to Transmission Lines" by NPTEL https://youtu.be/bi1nDg9CqRo?si=uNS9FUplRNZBkP8q (from 0 mint-19.30mint) 3. Homework - To draw equivalent circuit considering finite values of resistance inductance and capacitance of transmission lines. Spend 5 minutes to wrap up and consolidate the learnings
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. 3	Course Name: Microwave Devices & Systems Topic: Transmission lines	Course No.: ECE-503

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concepts of lossless and lossy transmission lines. b. Illustrate the differences between the two. c. Calculate the voltage and current distribution in both types of lines.
Teaching Aids (if any)	Power point presentation
Teaching Development	1. **Introduction** (5 minutes) Ask questions - What causes losses in transmission lines? - How would an ideal transmission line behave? Introduce the definitions of lossless and lossy transmission lines. Discuss real-world examples where each type is used. 2. **Development** (30 minutes) a. Lossless Transmission Lines - Define conditions for a lossless line (R = G = 0). - Derive the wave equations and discuss signal propagation. - Provide examples of practical lossless lines. b. Lossy Transmission Lines - Introduce resistance and conductance as sources of loss. - Derive the wave equations for lossy lines, introducing attenuation. - Discuss the impact of losses on signal integrity and power transfer. c. Basic Transmission Line. - Introduction to Transmission Lines. - Types of Transmission Lines. - Transmission Line Parameters. d. Concept of equivalent circuit in transmission line. - Short transmission lines. - Medium transmission lines. - Long transmission lines. - Characteristic Impedance and Propagation Constant. **3. Exercise (5 minutes)** - Solve a problem comparing a lossless and lossy line. - Discuss the impact of losses on the overall transmission.
Closure	1. Summarize the Lesson Learning Outcomes and confirm with students. 2. Suggested Reading: Transmission lines in “Electromagnetic Waves

	and Radiating Systems" by E.C. Jordan and K.G. Balmain. 3. Homework: Solve numerical problems on lossy transmission lines. Spend 5 minutes to wrap up and consolidate the learnings
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. 4	Course Name: Microwave Devices & Systems Topic: Transmission lines	Course No.: ECE-503

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of field analysis in transmission lines. b. Illustrate the electric and magnetic fields associated with transmission lines. c. Analyze the effects of these fields on signal propagation.
Teaching Aids (if any)	a. Power point presentation
Teaching Development	1. **Introduction** (5 minutes) Ask questions - What are the key parameters in field analysis? - How do electric and magnetic fields interact in transmission lines? Introduce the concept of field analysis in the context of transmission lines.. 2. **Development** (30 minutes) a. Electric Fields in Transmission Lines - Discuss the formation of electric fields between conductors. - Illustrate how the capacitance of the line is related to the electric field. - Solve a problem involving electric field calculation in a transmission line. b. Magnetic Fields in Transmission Lines Communication Systems. - Discuss the magnetic fields generated by current-carrying conductors. - Illustrate the inductance of the line as a result of magnetic fields. - Solve a problem involving magnetic field analysis. c. Basic Transmission Line. - Introduction to Transmission Lines. - Types of Transmission Lines. - Transmission Line Parameters. d. Concept of equivalent circuit in transmission line. - Short transmission lines. - Medium transmission lines. - Long transmission lines. - Characteristic Impedance and Propagation Constant.

	3. Exercise (5 minutes) - Solve a problem combining electric and magnetic field analysis in transmission lines. - Discuss how these fields affect signal propagation
Closure	1. Summarize the Lesson Learning Outcomes and confirm with students. 2. Suggested Reading: Field theory from "Engineering Electromagnetics" by William H. Hayt. 3. Homework - Solve field analysis problems for different transmission line configurations Spend 5 minutes to wrap up and consolidate the learnings
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. 4	Course Name: Microwave Devices & Systems	Course No.: ECE-503

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of impedance matching. b. Illustrate different methods for impedance matching. c. Calculate impedance matching for various transmission line scenarios.
Teaching Aids (if any)	a. Power point presentation
Teaching Development	1. **Introduction** (5 minutes) Ask questions - What is impedance, and why does it need to be matched? - What happens if impedance is not matched? Introduce the concept of impedance matching and its importance in transmission lines. 2. **Development** (30 minutes) a. Methods of Impedance Matching - Discuss different techniques: transformer matching, quarter-wave transformer, and stub matching. - Derive the equations for impedance matching in each method. - Solve a numerical problem involving impedance matching using a quarter-wave transformer. b. Practical Applications. - Discuss the application of impedance matching in real-world scenarios, such as antenna design and RF circuits. - Solve an impedance matching problem for an antenna system. c. Basic Transmission Line. - Introduction to Transmission Lines. - Types of Transmission Lines. - Transmission Line Parameters. d. Concept of equivalent circuit in transmission line. - Short transmission lines. - Medium transmission lines. - Long transmission lines. - Characteristic Impedance and Propagation Constant. **3. Exercise (5 minutes)** - Solve a problem using stub matching for impedance matching. - Discuss the solution and its practical implications.

Closure	1. Summarize the Lesson Learning Outcomes and confirm with students. 2. Suggested Reading: Impedance matching in "Microwave Engineering" by David Pozar. 3. Homework: Solve additional problems on impedance matching techniques. Spend 5 minutes to wrap up and consolidate the learnings
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. 5	Course Name: Microwave Devices & Systems	Course No.: ECE-503

Objectives	At the end of the lesson the student shall be able to: a. Comprehend the basics of Transmission Lines b. Equivalent circuit model of Transmission Lines
Teaching Aids (if any)	a. Power point presentation b. Chalk and Talk
Teaching Development	1. **Introduction** (5 minutes) Ask questions - What are the microwaves? - What are the possible ways to transmit a signal? - Have you seen transmission lines? Introduce the concept of Transmission lines: - Talk about the concept. - Introduce the formal definition of using examples - Highlight the important of such transmission. 2. **Development** (30 minutes) a. Properties of microwave. - Definition and Overview. - Frequency Range and Wavelength. - Sources of Microwaves (Natural and Artificial). b. Technological Applications of Microwaves. - Communication Systems. - Satellite Communication. - Wireless Networks. - Radar Technology. - Microwave Ovens. - Medical Applications. c. Basic Transmission Line. - Introduction to Transmission Lines. - Types of Transmission Lines. - Transmission Line Parameters. d. Concept of equivalent circuit in transmission line. - Short transmission lines. - Medium transmission lines. - Long transmission lines. - Characteristic Impedance and Propagation Constant. **3. Exercise (5 minutes)** - Comprehend the Basics of Transmission Lines With two nodes. - Comprehend the basics of Transmission Lines

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested reading: - Transmission Lines from K. D. Prasad - Introduction to Transmission Lines" by NPTEL https://youtu.be/bi1nDg9CqRo?si=uNS9FUplRNZBkP8q (from 0 mint-19.30mint) 3. Homework - To draw equivalent circuit considering finite values of resistance inductance and capacitance of transmission lines. Spend 5 minutes to wrap up and consolidate the learnings
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. 1	Course Name: Microwave Devices & Systems	Course No.: ECE-503

Objectives	At the end of the lesson the student shall be able to: a. Comprehend the basics of Transmission Lines b. Equivalent circuit model of Transmission Lines
Teaching Aids (if any)	a. Power point presentation b. Chalk and Talk
Teaching Development	1. **Introduction** (5 minutes) Ask questions - What are the microwaves? - What are the possible ways to transmit a signal? - Have you seen transmission lines? Introduce the concept of Transmission lines: - Talk about the concept. - Introduce the formal definition of using examples - Highlight the important of such transmission. 2. **Development** (30 minutes) a. Properties of microwave. - Definition and Overview. - Frequency Range and Wavelength. - Sources of Microwaves (Natural and Artificial). b. Technological Applications of Microwaves. - Communication Systems. - Satellite Communication. - Wireless Networks. - Radar Technology. - Microwave Ovens. - Medical Applications. c. Basic Transmission Line. - Introduction to Transmission Lines. - Types of Transmission Lines. - Transmission Line Parameters. d. Concept of equivalent circuit in transmission line. - Short transmission lines. - Medium transmission lines. - Long transmission lines. - Characteristic Impedance and Propagation Constant. **3. Exercise (5 minutes)** - Comprehend the Basics of Transmission Lines With two nodes. - Comprehend the basics of Transmission Lines

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested reading: - Transmission Lines from K. D. Prasad - Introduction to Transmission Lines" by NPTEL https://youtu.be/bi1nDg9CqRo?si=uNS9FUplRNZBkP8q (from 0 mint-19.30mint) 3. Homework - To draw equivalent circuit considering finite values of resistance inductance and capacitance of transmission lines. Spend 5 minutes to wrap up and consolidate the learnings
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. 1	Course Name: Microwave Devices & Systems	Course No.: ECE-503

Objectives	At the end of the lesson the student shall be able to: a. Comprehend the basics of Transmission Lines b. Equivalent circuit model of Transmission Lines
Teaching Aids (if any)	a. Power point presentation b. Chalk and Talk
Teaching Development	1. **Introduction** (5 minutes) Ask questions - What are the microwaves? - What are the possible ways to transmit a signal? - Have you seen transmission lines? Introduce the concept of Transmission lines: - Talk about the concept. - Introduce the formal definition of using examples - Highlight the important of such transmission. 2. **Development** (30 minutes) a. Properties of microwave. - Definition and Overview. - Frequency Range and Wavelength. - Sources of Microwaves (Natural and Artificial). b. Technological Applications of Microwaves. - Communication Systems. - Satellite Communication. - Wireless Networks. - Radar Technology. - Microwave Ovens. - Medical Applications. c. Basic Transmission Line. - Introduction to Transmission Lines. - Types of Transmission Lines. - Transmission Line Parameters. d. Concept of equivalent circuit in transmission line. - Short transmission lines. - Medium transmission lines. - Long transmission lines. - Characteristic Impedance and Propagation Constant. **3. Exercise (5 minutes)** - Comprehend the Basics of Transmission Lines With two nodes. - Comprehend the basics of Transmission Lines

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested reading: - Transmission Lines from K. D. Prasad - Introduction to Transmission Lines" by NPTEL https://youtu.be/bi1nDg9CqRo?si=uNS9FUplRNZBkP8q (from 0 mint-19.30mint) 3. Homework - To draw equivalent circuit considering finite values of resistance inductance and capacitance of transmission lines. Spend 5 minutes to wrap up and consolidate the learnings
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. 1	Course Name: Microwave Devices & Systems	Course No.: ECE-503

Objectives	At the end of the lesson the student shall be able to: a. Comprehend the basics of Transmission Lines b. Equivalent circuit model of Transmission Lines
Teaching Aids (if any)	a. Power point presentation b. Chalk and Talk
Teaching Development	1. **Introduction** (5 minutes) Ask questions - What are the microwaves? - What are the possible ways to transmit a signal? - Have you seen transmission lines? Introduce the concept of Transmission lines: - Talk about the concept. - Introduce the formal definition of using examples - Highlight the important of such transmission. 2. **Development** (30 minutes) a. Properties of microwave. - Definition and Overview. - Frequency Range and Wavelength. - Sources of Microwaves (Natural and Artificial). b. Technological Applications of Microwaves. - Communication Systems. - Satellite Communication. - Wireless Networks. - Radar Technology. - Microwave Ovens. - Medical Applications. c. Basic Transmission Line. - Introduction to Transmission Lines. - Types of Transmission Lines. - Transmission Line Parameters. d. Concept of equivalent circuit in transmission line. - Short transmission lines. - Medium transmission lines. - Long transmission lines. - Characteristic Impedance and Propagation Constant. **3. Exercise (5 minutes)** - Comprehend the Basics of Transmission Lines With two nodes. - Comprehend the basics of Transmission Lines

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested reading: - Transmission Lines from K. D. Prasad - Introduction to Transmission Lines" by NPTEL https://youtu.be/bi1nDg9CqRo?si=uNS9FUplRNZBkP8q (from 0 mint-19.30mint) 3. Homework - To draw equivalent circuit considering finite values of resistance inductance and capacitance of transmission lines. Spend 5 minutes to wrap up and consolidate the learnings
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. 9	Course Name: Microwave Devices & Systems Topic: Introduction to Microwaves	Course No.: ECE-503

Objectives	At the end of the lesson the student shall be able to: a. State and explain Maxwell's equations in static fields. b. Illustrate the physical significance of each equation. c. Apply Maxwell's equations to solve static field problems.
Teaching Aids (if any)	a. Power point presentation
Teaching Development	1. **Introduction** (5 minutes) Ask questions - What are Maxwell's equations? - Why are they important in electromagnetics? Introduce Maxwell's equations in static fields. 2. **Development** (30 minutes) a. Gauss's Law for Electricity. - State the equation and discuss its physical significance. - Solve an example problem using Gauss's Law. b. Gauss's Law for Magnetism - State the equation and discuss its implications. - Solve an example problem involving magnetic fields. c. Faraday's Law of Induction - State the equation and explain its role in electromagnetics. - Solve a problem involving induced electric fields. d. Ampère's Law - State the equation and discuss its application. - Solve a problem involving current-carrying conductors. **3. Exercise (5 minutes)** - Solve problems using Maxwell's equations for static fields.
Closure	1. Summarize the Lesson Learning Outcomes and confirm with students. 2. Suggested Reading: Static fields from "Electromagnetic Field Theory" by Matthew N.O. Sadiku. 3. Homework: Solve additional problems using Maxwell's equations in static fields Spend 5 minutes to wrap up and consolidate the learnings
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. 10	Course Name: Microwave Devices & Systems Topic: Introduction to Microwaves	Course No.: ECE-503

Objectives	At the end of the lesson the student shall be able to: a. State and explain Maxwell's equations in time-varying fields. b. Illustrate how time-varying fields affect electromagnetic wave propagation. c. Apply Maxwell's equations to solve time-varying field problems.
Teaching Aids (if any)	a. Power point presentation
Teaching Development	1. Introduction (5 minutes) Ask questions - How do Maxwell's equations change in time-varying fields? - What is the significance of these changes? Introduce Maxwell's equations in time-varying fields. 2. Development (30 minutes) a. Faraday's Law of Induction - State the time-varying form and discuss its implications. - Solve an example problem involving time-varying fields. b. Ampère's Law with Maxwell's Addition - State the time-varying form and explain its physical significance. - Solve a problem involving changing magnetic fields. c. Continuity Equation - Discuss its role in time-varying fields and derive the equation. - Solve an example problem. 3. Exercise (5 minutes) - Solve problems using Maxwell's equations for time-varying fields.
Closure	1. Summarize the Lesson Learning Outcomes and confirm with students. 2. Suggested Reading: Time-varying fields from "Principles of Electromagnetics" by Matthew N.O. Sadiku. 3. Homework: Solve additional problems using Maxwell's equations in time-varying fields. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.

	Spend 5 minutes to evaluate student assimilation of the lesson contents