| ***SEMESTER*** | ***DEPARTMENT*** | ***COURSE TITLE*** |
|---|---|---|
| *Sixth* | *Telecommunications Engineering* | *Transmission Lines* |
| ***COURSE CODE*** | ***HOURS*** 3 | ***COURSE SPECIFICATIONS*** |
| *ET609* | ***UNITS*** 3 | *Theoretical Content* |

**1.** ***Basic types of uniform RF transmission lines:***

- Define the Two-wire and Coaxial transmission lines.
- Explain and draw the structure of Two-wire and Coaxial lines.

**2.** ***Transmission line Equation:***

- Derive the transmission line equation.
- Determine the complete general solution of the transmission line equation.

**3.** ***Circuit model of uniform transmission lines:***

- Explain the circuit model of uniform transmission line.
- Define the primary line constants R, G, L, & C.
- Draw the circuit model of uniform lossy and lossless transmission lines.

**4.** ***The secondary line constants of transmission lines:***

- Define the propagation constant $\gamma$.
- Define the characteristic impedance $Z_0$.
- Express the propagation constant in terms of primary line constants.
- Express the characteristic impedance in terms of primary line constants.

**5.** ***Define and derive the following parameters:***

- Phase velocity of a wave travels on a transmission line.
- Wavelength of a wave travels on a transmission line and its frequency of operation.
- Attenuation constant and phase constant of a wave travels on a transmission line.

**6.** ***Reflections on transmission lines:***

- Define and derive expressions for voltage reflection coefficient, voltage standing wave ratio, and transmission coefficient.
- Define and derive the general expression of transmission line input impedance.
- Explain the difference between matched and mismatched lines.
- Properties of matched, open, and shorted transmission lines.

**7. *Impedance matching of lossless lines:***

- Matching using impedance transformers (quarter-wave & half-wave transformers).
- Lumped-element impedance matching.
- Single stub matching.
- Double stub matching.

**8. *The Smith chart:***

- Define the Smith chart and its importance as a graphical technique.
- Some uses of the Smith chart such as:
  - Voltage standing wave ratio.
  - Reflection coefficient.
  - Load impedance.
  - Input impedance at the generator.
  - Admittance of a load.
  - Distance from load to voltage minimum and voltage maximum.
  - Single stub matching.
  - Double stub matching.

**9. *Transient on transmission lines:***

- Determine the bounce diagram of voltage and current waves travelling in a lossless line terminated with a pure resistance.
- Sketch the voltage at load and generator as a function of time.
- Sketch the current at load and generator as a function of time.

**10. *Strip transmission lines:***

- Distinguish between different types of strip lines.
- Characteristic impedance of Microstrip lines.
- Losses in Microstrip lines.
- Quality factor of Microstrip lines.

***References:***

1. Liao Samuel. Y, ***Microwave Devices and Circuits***, 3rd Edition, Prentice-Hall.
2. Matthew N. O. Sadiku, ***Elements of Electromagnetics***, 4th Edition, Oxford University

Press.

3. Inan, U. S. & Inan A. S., ***Engineering Electromagnetics***, Addison Wesley Longman, Inc.
4. Paul, Clayton R., Whites, Keith W, & Nasar, S. A., ***Introduction to Electromagnetic Fields***, 3rd Edition, McGraw-Hill Book Company, Inc.
5. Paul, Clayton R., ***Electromagnetics for Engineers***, John Wiley & Sons, Inc.