

Department of Technical Education
DIPLOMA COURSE IN ELECTRONICS AND COMMUNICATION
ENGINEERING
Third Semester
Subject: EC303 ANALOG COMMUNICATION

Contact Hrs/Week: 4

General Educational Objectives

Contents	No of Hrs
Unit I	
Electrical Networks	
Network Theorems	7
Resonance	4
Filters	4
Attenuators and Equalizers	4
Unit II	
Transmission Lines, Antennas and Wave Propagation	
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Antennas	6
Wave Propagation	5
Unit III	
Communication Basics	
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Industry Innovations	4
(Students should collect and present the Latest Developments in the Field	
TOTAL	64

Unit I Electrical Networks

1. Understand network theorems and solve simple networks using the same.
2. Recognize the characteristics of series and parallel resonant circuits and perform simple calculations .
3. Classify filters based on different parameters and design passive LPF and HPF.
4. Understand the need for attenuators & equalizers and design attenuators.

Unit II Transmission Lines, Antennas and Wave Propagation

1. Understand the types and characteristics of transmission lines.
2. Know the working of antenna and get familiarized with antenna terminology.
3. Understand the different modes of wave propagation.

Unit III Communication Basics

1. Describe the AM, FM and PM process.
2. Comprehend the working of AM and FM detectors
3. Draw, identify and explain the various blocks of AM and FM transmitters.
4. Draw, identify and explain the various blocks of AM and FM receivers.

Specific Instructional Objectives

Unit I Electrical Networks

- 1.1 Network Theorems
 - 1.1.1 State superposition theorem
List the steps to solve a network using superposition theorem
Solve simple resistive networks involving not more than two dc sources.
 - 1.1.2 State Thevenin's theorem
List the steps to solve a network using Thevenin's theorem
Solve simple resistive networks involving not more than two dc sources.
 - 1.1.3 State Maximum Power Transfer theorem.
List the steps to solve a network using maximum power transfer theorem
Solve simple resistive networks involving not more than two dc sources.
 - 1.1.4 State Norton's Theorem and write its Equivalent circuit.**
- 1.2 Resonance
 - 1.2.1 Define resonance.
List the types of resonance.
Mention the applications of resonance.
 - 1.2.2 Draw the circuit diagram, phasor diagram and resonance curve for series resonance. List the characteristics of series resonance.
 - 1.2.3 Derive the following expressions for series resonance:
 - (a) Condition for resonance.
 - (b) Frequency of resonance.
 - 1.2.4 Write the Expressions for Impedance, current, voltage, Q factor and power factor, Bandwidth in terms of Q.
 - 1.2.5 Solve simple problems on series resonance
 - 1.2.6 Derive the following expressions for parallel resonance:
 - (a) Condition for resonance.
 - (b) Frequency of resonance.
 - 1.2.7 Write the Expressions for Impedance, current, voltage, Q factor and power factor, Bandwidth in terms of Q.
 - 1.2.8 Solve simple problems on parallel resonance.
- 1.3 Filters
 - 1.3.1 Define 'Filter'
Define cut-off frequency, pass band and stop band.
Give the classification of filters based on circuit elements, fall-off rate, etc.
Plot the ideal characteristics of passive LPF, HPF, BPF and BRN.
 - 1.3.2 Draw the T and Π configurations of constant K LPF and HPF.
Derive the formulae for calculating the values of L, C and f_c .
 - 1.3.3 Design constant K - LPF and HPF (T and Π type) using the above formulae.
 - 1.3.4 Explain with block diagrams, how to realize BPF & BRN using LPF & HPF.
- 1.4 Attenuators and Equalizers**
 - 1.4.1 Define attenuation.
Give the classification and applications of attenuators.
Define Bel, Decibel and Neper.
Establish relationship between Bel, Decibel and Neper.
 - 1.4.2 Express attenuation in dB.
Draw the symmetrical T and Π attenuator configurations.
Derive the formulae for calculating R1 and R2.
 - 1.4.3 Design symmetrical T and Π attenuators.
 - 1.4.4 Define 'Equalizer'
Give the classification.
Mention its applications.

Unit II

- 2.1 Transmission Lines.**
- 2.1.1 Define 'Transmission line'
Know about different types of Transmission lines (such as power lines, Parallel wire, coaxial, Wave guide). Mention their applications.
- 2.1.2 Draw the electrical model of a transmission line.
Define primary constants: R, L, G and C.
Define secondary constants: Characteristic impedance and Propagation Constant - simple problems.
Write the expressions for secondary constants in terms of primary constants.
- 2.1.3 Explain the following phenomena:
(a) Reflection and (b) Standing waves
Derive expressions for:
(a) Standing wave ratio
(b) Reflection coefficient
(c) Standing wave ratio in terms of reflection coefficient
(d) Reflection coefficient in terms of standing wave ratio.
- 2.1.4 Plot standing wave patterns for Voltage & Current on:
(a) Short circuited line
(d) Open circuited line
- 2.1.5 Explain the following impedance matching techniques:
(a) Single stub matching
(b) Double stub matching
(c) Quarter wave transformer.

3 Antennas and Wave Propagation

Antennas

- 3.1 Explain the general concept of setting up of electric and magnetic fields in a dipole. Define the following terms:
(a) Polarization,
(b) Isotropic radiator
(c) Radiation pattern
(d) Directive gain
(e) Directivity
(f) Power gain,
(g) Antenna resistance
(h) Antenna efficiency
(i) Beam width
- 3.2 Define 'antenna array'
Mention the Types of Arrays ,
Explain the working of broadside and endfire array.
Mention their applications.
Know the working of Parabolic reflector (Dish Antenna) – Feed mechanisms – Cassegrain and Horn feed
- 3.3 Wave Propagation
- 3.4 Fundamentals of Electromagnetic Waves.
- 3.5 Electromagnetic spectrum used for Communication.
- 3.6 Explain the following modes of wave propagation
(a) Ground wave propagation
(b) Sky wave propagation
(c) Space wave propagation.
- 3.7 Comparison of the above modes of propagation .

Unit III Communication Basics

4.1 Modulation

- 4.1.1 Explain the block diagram of electronic communication system.
Distinguish between analog and digital communication.
Define modulation.
Explain the need for modulation.
List the various analog modulation techniques.
- 4.1.2 Define 'Amplitude modulation'.
Sketch the AM wave.
Write mathematical expressions for the following:
(a) Modulating signal
(b) Carrier
(c) Components present in the AM output
(d) Modulation index in terms of V_m and V_c
(e) Modulation index in terms of V_{max} and V_{min}
(f) Modulation index in case of simultaneous modulations.
(g) LSB and USB
(h) Bandwidth
(I) Power in AM wave
Solve simple problems
Explain Amplitude Modulator circuit using diode (Refer Frenzel).
Define SSB, DSB and VSB. List their merits, demerits and applications.
- 4.1.3 Define 'Frequency Modulation'
Sketch the FM wave.
Write mathematical expressions for the following:
(a) Frequency deviation
(b) Modulation index
(c) Relationship between frequency deviation and modulation index
(d) Carson's rule for bandwidth.
Solve simple problems.
List the methods of generating FM
Explain Varactor diode method of generating FM.
Explain the need for pre-emphasis and de-emphasis circuits.
Highlight the merits and demerits of FM over AM
Define 'Phase modulation'.

4.2 Transmitters

- 4.2.1 Explain the working of AM transmitter using Low level and High level modulation. Discuss the merits and demerits.
- 4.2.2 Explain the working of FM Transmitter with Block Diagram.

5.1 Demodulation

- 5.1.1 Explain the working of AM Linear diode detector circuit.
- 5.1.2 Explain the working of the following FM detectors:
(a) Foster Seeley discriminator
(b) Ratio detector

5.2 Receivers

- 5.2.1 Explain the working of AM TRF receiver with Block Diagram. List its Limitations.
- 5.2.2 Explain the working of AM Super Heterodyne Receiver with Block Diagram. Highlight its merits. Discuss briefly about choice of IF.
- 5.2.3 Characteristics of Receivers - Selectivity, Sensitivity, Gain, Fidelity, Image Frequency and its Rejection, Double Spotting, Noise Figure.
- 5.2.4 Discuss the need for AGC. Distinguish between normal AGC and delayed AGC.
- 5.2.5 Explain the working of FM receiver with Block Diagram.

Text Book:

1. Electronic Communication Systems

- by George Kennedy and Bernard Davis TMH fourth edition

2. Networks and transmission lines - by Umesh Sinha

REFERENCES

1. Electronic Communication systems by William Schweber
Fourth Edition Prentice- Hall of India Publications
2. Analog Communication Systems by P. Chakrabarti
- 3.. Electronic Communication by Dennis Roddy and John
Coolen Prentice -Hall of India Publications
4. Analog Communication By- K Shashidhar, Sapna Publications

**DERARTMENT OF TECHNICAL EDUCATION
DIPLOMA COURSE IN ELECTRONICS & COMMUNICATION ENGG.
THIRD SEMESTER**

**MODEL QUESTION PAPER
ANALOG COMMUNICATION**

MAX MARKS:100

TIME :3Hrs

INSTRUCTIONS:-

- 1 SECTION-I IS COMPULSORY
- 2 ANSWER ANY TWO FULL QUESTIONS FROM EACH OF THE REMAINING SECTIONS.

SECTION I

- 1 A) **FILL IN THE BLANKS WITH APPROPRIATE WORDS:-** **1X5**
- i) The current at Resonance in Series Resonance circuit is _____.
 - ii) The cut off frequency of LPF is given by _____.
 - iii) The Attenuator is a _____ Network.
 - iv) The characteristic impedance of transmission line is given by _____.
 - v) The modulation index in FM is given by _____.
- B) Write a note on Equalizers. **5**

SECTION :II

- 2 a) State Superposition theorem . **3**
 - b) List the steps involved in simplifying the network using the Superposition theorem. **5**
 - c) Define Resonance . Derive the expression for Resonant frequency of Parallel Resonance circuit. **7**
- 3 a) Derive the expression for L and C of constant K – T section LPF. **7**
 - b) Design constant K - PI section HPF given $f_c = 2 \text{ KHz}$, $R_o = 600 \text{ ohms}$. **5**
 - c) Find the relationship between Decibel and Neper. **3**
- 4a) Define Attenuator and mention its Applications. **4**
 - b) Design T –type attenuator given attenuation =10 dB , $R_o = 600 \text{ ohms}$. **5**
 - c) State Norton's Theorem and write its Equivalent circuit. **6**

SECTION :III

- 5a) Describe the electrical model of Transmission line.. **4**
b) Explain the following :
(a) Reflection and (b) Standing waves in Transmission Line. **4**
c) Derive the Relationship between SWR and Reflection Coefficient. **7**
- 6 a) Define the following terms w.r.t Antenna :
(a) Polarization,
(b) Isotropic radiator
(c) Radiation pattern
(d) Directive gain
(e) Directivity **10**
b) Explain the working of broadside array. **5**
- 7 a) Explain Single stub matching . **5**
b) Explain Ground wave propagation with relevant diagram. **6**
c) Explain propagation in a mobile/portable environment . **4**

SECTION : IV

- 8a) Explain the need for Modulation. **4**
b) Explain amplitude modulator circuit using diode. **5**
c) Sketch the FM wave. Write mathematical expressions for the following:
(a) Frequency deviation
(b) Modulation index **6**
- 9a) Explain the working of AM Linear diode detector circuit. **5**
b) Explain the working of Foster Seeley discriminator . **6**
c) Explain the need for pre-emphasis and de-emphasis circuits. **4**
- 10a) Explain the working of High level AM transmitter with a neat block diagram. **8**
b) Explain the working of FM receiver with Block Diagram. **7**