



**Reading List for the PhD Comprehensive Exam
Electromagnetic Waves Specialization
(Academic Year 2011 – 2012)**

Part I: Waveguides Circuit Theory and Impedance Matching

Responsible Faculty: Dr. Hadia EL-HENNAWY (Professor of Electromagnetic Waves at Ain Shams University)

Book Title: Foundations for Microwave Engineering

By Collin, R. E.

Publisher: McGraw-Hill, New York, 1996.

Topics:

- 1) Chapter 4: Circuit Theory for Waveguiding Systems
- 2) Chapter 5: Impedance Transformation and Matching

Part II: Antenna Theory And Design

Responsible Faculty: Dr. Essam HASHISH (Professor of Electromagnetic Waves at Cairo University)

Book Title: Antenna Theory And Design

By : Robert S. Elliott

Publisher: John Wiley & Sons., 2003.

Topics:

2 Radiation Patterns of Dipoles, Loops, and Helices 58

2.1 Introduction 58

2.2 The Center-Fed Dipole 58

2.3 Images in a Ground Plane 65

2.4 A Monopole Above a Ground Plane 67

2.5 A Dipole in Front of a Ground Plane 68

2.6 The Small Current Loop 69



2.7 Traveling Wave Current on a Loop 71

2.8 The End-Fire Helix 73

3 Radiation Patterns of Horns, Slots and Patch Antennas 79

3.1 Introduction 79

3.2 The Open-Ended Waveguide 79

3.3 Radiation from Horns 83

3.4 Center-Fed Slot in Large Ground Plane 86

3.5 Waveguide-Fed Slots 88

3.6 Theory of Waveguide-Fed Slot Radiators 91

3.7 Patch Antennas 99

4 Linear Arrays: Analysis 113

4.1 Introduction 113

4.2 Pattern Formulas for Arrays with Arbitrary Element Positions 114

4.3 Linear Arrays: Preliminaries 117

4.4 Schelkunoff's Unit Circle Representation 128

5 Linear Arrays: Synthesis 141

5.1 Introduction 141

5.2 Sum and Difference Patterns 142

5.3 Dolph-Chebyshev Synthesis of Sum Patterns 143

5.4 Sum Pattern Beamwidth of Linear Arrays 148

5.5 Peak Directivity of the Sum Pattern of a Linear Array 153

5.6 A Relation Between Beamwidth and Peak Directivity for Linear Arrays 157

5.7 Taylor Synthesis of Sum Patterns 157

5.8 Modified Taylor Patterns 162

5.9 Sum Patterns with Arbitrary Side Lobe Topography 165

5.10 Discretization of a Continuous Line Source Distribution 172

5.11 Bayliss Synthesis of Difference Patterns 181

5.12 Difference Patterns with Arbitrary Side Lobe Topography 185

5.13 Discretization Applied to Difference Patterns 187

5.14 Design of Linear Arrays to Produce Null-Free Patterns 190

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Part III: Propagation of Radio Waves

Responsible Faculty: Dr. Adel Zaki BOTROS (Associate Professor of Electromagnetic Waves at Cairo University)

Books:

Title : *Electromagnetic Waves & Radiating Systems*

By Jordan, E.C.

Publisher: Prentice Hall, Inc., N.J., 1950.

Title : *Antennas and Radio Wave Propagation*

By Collin, R.E.

Publisher: Mc-Graw Hill Book Company, 1985.

Title : *Foundations for Microwave Engineering*

By Collin, R.E.

Publisher: Mc-Graw Hill Book Company, 1985.

Topics:

- 1) General aspects of radio wave propagation.
- 2) Scattering matrix for a two port junction.
- 3) Coverage diagrams for ground wave propagation.
- 4) Field structure on the surface of earth

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Part IV: Microwave Periodic Structures and Filters

Responsible Faculty: Dr. Hanna A. KIROOUS (Associate Professor of Electromagnetic Waves at Cairo University)

Books:

Title : *Microwave Engineering*

By Pozar, D. M

Publisher: Addison-Wesley, 1990

Title : *Foundations for Microwave Engineering*

By Collin, R. E.

Publisher: McGraw-Hill, New York, 1996

Topics:

- 1) Capacitively loaded Transmission-Line Circuit Analysis
- 2) Wave analysis of Periodic Structures.
- 3) Periodic Structures Composed of Unsymmetrical Two-Port Networks
- 4) Terminated Periodic Structures
- 5) Matching of Periodic Structures
- 6) $k_0 - \beta$ Diagram.
- 7) Floquet's Theorem and Spatial Harmonics
- 8) Introduction to Microwave Filters
- 9) Image-Parameter Method of Filter Design
- 10) Filter Design by Insertion Loss Method
- 11) Specification of Power Loss Ratio
- 12) Some Low-Pass Filter Design

Part V: Subject Selected by Adviser

Responsible Faculty: The head of the advising committee of the student.