



Ankara Yıldırım Beyazıt University
Electrical and Electronics Engineering Department
PhD Qualification Exam Field Selection Form

Name:

ID number:

Signature:

Select and solve **7** of the questions according to the directions below.

	Check ✓	SUBJECT	SUGGESTED BOOK*
UNDERGRADUATE COURSES SELECT ONLY 3 OF THESE		1. <i>Electrical Circuits</i>	<i>Alexander & Sadiku, Fundamentals of Electric Circuits</i>
		2. <i>Electronics</i>	<i>Razavi, Fundamentals of Microelectronics</i>
		3. <i>Electromagnetic Fields</i>	<i>Cheng, Field and Wave Electromagnetics</i>
		4. <i>Digital Design</i>	<i>Mano & Ciletti, Digital Design</i>
		5. <i>Control Systems</i>	<i>N.Nise, Control Systems Engineering</i>
		6. <i>Signals and Systems</i>	<i>Oppenheim, Signals and Systems</i> <i>Oppenheim, Discrete-Time Signal Processing</i>
		7. <i>Electromechanical Energy Conversion</i>	<i>Chapman, Electric Machinery Fundamentals</i>
M.Sc. COURSES SELECT 2		1.	
		2.	
Ph.D. COURSES SELECT 2		1.	
		2.	

* The exam questions are NOT constrained with the specified books.

** Students can NOT choose more than 2 courses given by their supervisors.

The following Subjects will include the topics given below:

- **ELECTRICAL CIRCUITS**

1. Methods of Analysis: Nodal Analysis, Nodal Analysis with Voltage Sources
2. Mesh Analysis, Mesh Analysis with Current Sources
3. Circuit Theorems: Linearity Property, Superposition, Source Transformation
4. Thevenin's Theorem, Norton's Theorem
5. Maximum Power Transfer, Capacitors, and Inductors: Capacitors, Series and Parallel Capacitors
6. Inductors, Series and Parallel Inductors,
7. First order circuits: The Source-Free RC Circuit, The Source-Free RL Circuit, Singularity Functions
8. Step Response of RC Circuit, Step Response of RL Circuit.
9. Sinusoids, Phasors, Phasor Relationships for Circuit Elements, Impedance and Admittance
10. Kirchhoff's Laws in the Frequency Domain, Impedance Combinations, Sinusoids AC analysis: Nodal analysis, mesh analysis.
11. Superposition Theorem, Source Transformation
12. Applications of the Laplace Transform

- **ELECTROMAGNETIC FIELD AND WAVES**

1. Vector algebra (Chapter 2)
2. Static electric fields (Chapter 3)
 - Coulomb's law – Gauss's law – electric field due to discrete and continuous charge distribution – electric potential – boundary conditions – fields in dielectric and conducting materials – force and energy
 - Method of image – stray and mutual capacitance
3. Static magnetic fields (Chapter 6)
 - Vector magnetic potential – Biot-Savary law – behavior of different magnetic materials – magnetic flux – magnetic circuits – boundary conditions – force and energy – self and mutual inductance
4. Time varying electromagnetic waves (Chapter 7)
 - Ampere's law – Faraday's law - Maxwell's equations in differential and integral forms – boundary conditions – Time harmonic field expressions
5. Uniform plane waves (Chapter 8)
 - Plane wave in free space – plane wave in lossy and ionized media – doppler frequency – wave polarization – wave impedance – group velocity

- **DIGITAL DESIGN**

1. Number Systems
 - Conversion between binary, decimal, octal, hexadecimal systems including fractional numbers

- Binary Codes
- Unsigned numbers
- Signed number systems
 - Signed Magnitude
 - One's Complement
 - Two's Complement
- Range of unsigned and signed numbers
- Overflow and saturation
- Floating point format

2. Boolean Algebra

- Properties of Boolean algebra
- Simplification using Boolean algebra
- Boolean logic gates, truth tables
- 3 and 4 variable Karnaugh maps
- Universality of NAND and NOR implementations
- Don't care conditions

3. Combinational Circuits

- Binary adders
- Subtractors
- Multipliers
- Comparators
- Encoders and decoders
- Multiplexers and demultiplexers

4. Sequential Circuits

- D-flip-flops
- Mealy and Moore Finite State Machine Design
 - State diagrams and state tables
- Counters
- Shift registers

• **MICROPROCESSORS**

Introduction to embedded systems and fundamental concepts

- Microcontroller vs Microprocessors
- CISC vs RISC processors
- Von Neumann and Harvard architectures
- General purpose and special Registers
- Memory
- How a CPU works
- Addressing modes
- Operation modes
- Interrupts and Exceptions
- Bus structure

Introduction to ARM assembly language programming:

- Memory Instructions: Loading and Storing Data
- Arithmetic instructions
- Logical instructions
- Rotate instructions
- Bitwise operations

- Conditional Execution and Branching
- Subroutines
- Stack and Functions

- **CONTROL SYSTEMS**

1. Mathematical Modelling of Dynamic Systems (Electrical, Mechanical and Electro-Mechanical Systems).
2. Time Response
3. Stability and Steady-State Errors
4. Root-Locus Analysis
5. Frequency Response Analysis (Bode and Nyquist Diagrams)
6. Controller Structure and Design

- **SIGNALS and SYSTEMS**

1. System concepts (linearity, causality, stability, time-invariance) and LTI systems
2. Basic continuous and discrete time functions (delta, step and complex exponential functions)
3. Discrete and continuous time signals and sampling
4. Impulse response (system concepts in terms of impulse response)
5. Transforms and transfer functions (Fourier, Laplace, z-transforms)
6. Discrete Time Fourier Transform (FT), Discrete (DFT) and Fast (FFT) FT

- **TELECOMMUNICATIONS**

1. FREQUENCY DOMAIN ANALYSIS OF SIGNALS AND SYSTEMS

Fourier Series, Fourier Series for Real Signals(the Trigonometric Fourier Series), Fourier Transforms, Power and Energy.

2. ANALOG SIGNAL TRANSMISSION AND RECEPTION

Amplitude Modulation (AM), Double-Sideband Suppressed Carrier AM, conventional Amplitude Modulation, Single-Sideband AM, Vestigial-Sideband AM, Signal Multiplexing, Angle (Phase) Modulation, Representation of FM and PM Signals, Spectral Characteristics of Analog Modulated Signals.

3. RANDOM (STOCHASTIC) PROCESSES

Random Processes: Fundamental Concepts, Stationary Processes, Random Processes and Linear Systems, Power Spectrum of Stochastic Processes.

4. EFFECT OF NOISE ON ANALOG COMMUNICATION SYSTEMS

Effect of Noise on Linear-Modulation Systems, Effect of Noise on a Baseband System, Effect of Noise on DSB-SC AM, Effect of Noise on SSB AM, Effect of Noise on Conventional AM, Effect of Noise on Angle Modulation, Pre-emphasis and De-emphasis Filtering, Comparison of Analog-Modulation Systems, Effects of Transmission Losses and Noise in Analog Communication Systems.

5. ANALOG TO DIGITAL and DIGITAL TO ANALOG CONVERSION

Sampling, Quantization, Pulse-Code Modulation (PCM), Differential Pulse-Code Modulation (DPCM), Delta Modulation, Analysis-Synthesis Techniques.

6. DIGITAL TRANSMISSION (MODULATION) THROUGH THE ADDITIVE WHITE GAUSSIAN NOISE CHANNEL

Geometric Representation of Signal Waveforms, Pulse Amplitude Modulation, Pulse Position Modulation, Phase-shift keying, Frequency-shift keying, Quadrature Amplitude Modulation, Orthogonal Signal Waveforms.

7. OPTIMUM RECEIVER FOR DIGITALLY MODULATED SIGNALS IN ADDITIVE WHITE GAUSSIAN NOISE

Correlation-Type Demodulator, Matched-Filter-Type Demodulator, The Optimum Detector, Demodulation and Detection of Digitally Modulated Signals, Probability of Error for Signal Detection in Additive White Gaussian Noise for Digital Modulation Techniques.

8. DIGITAL TRANSMISSION THROUGH BANDLIMITED AWGN CHANNELS

Digital Transmission through Bandlimited Channels , Digital PAM Transmission through Bandlimited Baseband Channels, Digital Transmission through Bandlimited Bandpass Channels, Design of Bandlimited Signals for Zero ISI—The Nyquist Criterion, Design of Bandlimited Signals with Controlled ISI—Partial Response

• **ELECTRONICS**

1. BASIC PHYSICS OF SEMICONDUCTORS
2. DIODE MODELS AND CIRCUITS
3. PHYSICS OF BIPOLAR TRANSISTORS
4. BIPOLAR AMPLIFIERS
5. PHYSICS OF MOS TRANSISTORS
6. CMOS AMPLIFIERS
7. CASCODE STAGES AND CURRENT MIRRORS
8. DIFFERENTIAL AMPLIFIERS