**THE NATIONAL COUNCIL OF EXAMINERS FOR ENGINEERING AND SURVEYING**
**PRINCIPLES AND PRACTICE OF ENGINEERING EXAMINATION**

# ELECTRICAL AND COMPUTER
# (Depth – Electronics, Controls, and Communications)

**EFFECTIVE April 2002**

The electrical and computer engineering examination is a breadth and depth examination. This means that **all** examinees work the breadth (AM) exam and **one** of the three depth (PM) exams. The breadth exam contains questions from the general field of electrical and computer engineering. The depth exams focus more closely on a single area of practice in electrical and computer engineering. The three depth examinations are Computers; Electronics, Controls and Communications; and Power.

| **Electronics, Controls, and Communications Depth Module (PM)** | Approximate Percentage of Examination |
|---|---|
| **I. General Electrical Engineering Knowledge** | **10%** |
| A. Measurement and Instrumentation | 4% |
| 1. Transducer Characteristics | |
| 2. Frequency Response | |
| 3. Quantization | |
| 4. Data Evaluation | |
| 5. Sampling Theory | |
| B. Interpretation of Codes and Standards | 2% |
| 1. ANSI Standards | |
| 2. NEC (code) | |
| 3. IEEE Standards | |
| 4. FCC Standards | |
| 5. EIA Standards | |
| 6. ISA Standards | |
| 7. ISO Standards | |
| C. Computer Systems | 4% |
| 1. Programmable Logic Devices | |
| 2. Computer Networks | |
| 3. Number Systems and Codes | |
| 4. Digital Electronic Devices | |

Approximate Percentage of Examination

**II. Electronics** **35%**

A. Electric Circuit Theory 10%

1. Small Signal and Large Signal
2. Active Networks and Filters
3. Delay
4. Distributed Parameter Circuits
5. Nonlinear Circuits
6. Two Port Theory
7. Phase Delay

B. Electric and Magnetic Field Theory and Applications 7%

1. Microwave Systems
2. Transmission Line Models
3. Electromagnetic Fields and Interference
4. Antennas
5. Free Space Propagation
6. Guided Wave Propagation

C. Electronic Components and Circuits 18%

1. Programmable Logic Devices
2. Programmable Gate Arrays
3. Solid State Power Devices and Applications
4. Battery Characteristics and Ratings
5. Power Supplies
6. Phase Locked Loops
7. Oscillators
8. Amplifiers
9. Modulators and Demodulators
10. Discrete Components
11. Diodes
12. Circuit Protection
13. Relays and Switches
14. Logic Components
    a. Properties
    b. Fan In, fan Out
    c. Propagation Delay
15. Transistors and Applications

**III. Controls** **25%**

A. Control System Fundamentals 10%

1. Difference Equations
2. z - Transform
3. Frequency Response
4. Characteristic Equations
5. Block Diagrams
6. State Variable Analysis

Approximate Percentage of Examination

B. Control System Design/Implementation 6%

1. Compensators
2. Feed Forward
3. Feedback
4. Optimal Control Systems
5. Adaptive Control
6. Computer Control and Monitoring
7. Error Actuated Control
8. Proportional-Integral-Derivative Control

C. Stability 9%

1. Stability Analysis and Design
   a. Nyquist Stability
   b. Root Locus
   c. Bode Diagrams

2. Poles and Zeros
3. Phase and Gain Margin
4. Transport Delay

**IV. Communications 30%**

A. Communications and Signal Processing 15%

1. Modulation Theory
   a. Linear Modulation
   b. Angle Modulation
   c. Pulse Modulation

2. Correlation and Convolution
3. Fourier Transforms
4. Spectral Properties
5. Signal Processing
6. Digital Transmission
7. Quadrature Amplitude Modulation
8. Personal Communication System
9. Spread Spectrum Modulation
10. Adaptive Filtering
11. Nyquist Sampling Theorem

B. Noise and Interference 8%

1. Signal to Noise Ratio
2. Quantization Noise
3. Noise Figure and Temperature
4. Aliasing
5. Random Variables
6. Error Detection and Correction

| | Approximate Percentage of Examination |
|---|---|
| C. Telecommunications | 7% |
| 1. Wireless Communications | |
| 2. Compression | |
| 3. Cellular Communications | |
| 4. Optical Communications | |
| 5. Circuit and Packet Switching | |
| 6. Network Distribution Systems | |
| 7. Wireline Communications | |
| **TOTAL** | **100%** |

**NOTES:**

1. The knowledge areas specified under A, B, C, ... etc., are examples of kinds of knowledge, but they are not exclusive or exhaustive categories.

2. Each depth (PM) exam contains 40 multiple-choice questions. Examinee chooses **one** depth exam and works all questions in the depth exam chosen.