**BOROUGH OF MANHATTAN COMMUNITY COLLEGE**
The City University of New York
Department of Science

# TITLE: SWITCHING THEORY AND LOGIC DESIGN

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| Course Code: | **ESC 223** |
| Lecture Hours per Week | 2 |
| Laboratory Hours per Week | 3 |
| Credits | 3 |

**A. Description**

This course entails a study of digital logic and its applications. Topics include: Logic Circuits, Karnaugh Maps, Design techniques for combinational and sequential circuits, basic computer architecture and hardware-software relationships. A laboratory component is integrated into the course.

**B. Prerequisites:** MAT 302, PHY 225, SCI 120 or SCI 121

**C. Objectives**

To familiarize the student with the theory of logic circuits and their applications to computers and industrial apparatus.

**D. Required Text:** M. Morris Mano: Digital Design; Prentice Hall Publishing, 5th Edition; ISBN# 13-978-132774208

A.J. Creaco: Switching Systems and Logic Design Laboratory Manual
ISBN# 13-978-0-558-09350-1

**E. Evaluation:**

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| Class Examination (3-5) | 45% |
| Final Examination | 35% |
| Laboratory Reports | 20% |

**Students with disabilities who require reasonable accommodations or academic adjustments for this course must contact the Office of Services for Students with Disabilities (Room N769; Telephone # 220-8180). BMCC is committed to providing equal access to all programs and curricula to all students.**

| **Course Student Learning Outcomes (Students will be able to…)** | **Measurements (means of assessment for student learning outcomes listed in first column)** |
|---|---|
| 1. Identify and apply the fundamental concepts and methods of Boolean Algebra and mathematical manipulations of binary, octal, and hexadecimal numbers. | 1. Graded problems involving calculations based on a lab exercise: exam questions. |
| 2. Development of a Boolean algebraic expression based on the criteria of a practical problem and its implementation to a digital logic circuit. | 2. Graded problems involving calculations based on a lab exercise: exam questions. |
| 3. Demonstrate the proficiency of using a computer to realize a digital logic circuit using a Verilink compiler and physically implement the circuit. | 3. Laboratory projects will require the use of the Verilink compiler from the XILINX software suite to implement all necessary digital logic designs. |
| 4. Analyze, and interpret digital designs and present it in an effective written laboratory report. | 4. Graded lab reports, where students will report, analyze and present digital output from a logic design. |

| | **General Education Learning Outcomes** | **Measurements (means of assessment for general education goals listed in first column)** |
|---|---|---|
| | **Communication Skills-** Students will be able to write, read, listen and speak critically and effectively. | |
| ☑ | **Quantitative Reasoning-** Students will be able to use quantitative skills and the concepts and methods of mathematics to solve problems. | Graded lab exercise and exam questions involving mathematical proofs in Boolean Algebra: exam questions |
| ☑ | **Scientific Reasoning-** Students will be able to apply the concepts and methods of the natural sciences. | Graded lab exercise and exam questions involving the determination of optimal digital logic circuit design based on criteria of the solution to a practical problem. |
| | **Social and Behavioral Sciences-** Students will be able to apply the concepts and methods of the social sciences. | |
| | **Arts & Humanities-** Students will be able to develop knowledge and understanding of the arts and literature through critiques of works of art, music, theatre or literature. | |
| | **Information & Technology Literacy-** Students will be able to collect, evaluate and interpret information and effectively use information technologies. | |
| | **Values-** Students will be able to make informed choices based on an understanding of personal values, human diversity, multicultural awareness and social responsibility. | |

## LECTURE SYLLABUS

| WEEK | TOPIC | CHAPTER |
|---|---|---|
| 1 | Binary, Octal and Hexadecimal Systems | 1 |
| 2, 3 | Boolean Algebra and Logic Gates | 2 |
| 4,5 | Simplification of Boolean Functions: Karnaugh Maps and their use in the Design of Combinational Circuits. | 3 |
| 6,7 | Combinational Logic, Design of Circuits using NAND, NOR, and Exclusive OR gates. | 4 |
| 8, 9 | Combinational Logic with MSI and LSI | 5 |
| 10, 11 | Synchronous Sequential Logic | 6 |
| 12, 13 | Registers, Counters, and Memory Units | 7 |
| 14 | Review and Final Examination | |

## LABORATORY SYLLABUS

| WEEK | TOPIC |
|---|---|
| 1 | Laboratory Familiarization: Introduction of Breadboarding: Use of the Oscilloscope, Digital Multimeter, Function Generator, and Logic Probe. |
| 2 | Digital Logic Gates: NAND, NOR INVERTER, AND, OR, XOR |
| 3 | Boolean Laws and Theorems: Simplification of Boolean Functions |
| 4 | Demorgan's Theorem |
| 5 | Implementation of Circuits Using Don't Care Conditions |
| 6 | Digital Binary Adders |
| 7 | Design and Implementation of the BCD-To-Seven Segment Decoder |
| 8 | Implementation of Circuits Using NAND and NOR Gates |
| 9 | Decoders and Multiplexers |
| 10 | Flip-Flops |
| 11 | Analysis of the 3-bit Counter |
| 12 | Design of a Synchronous Sequential Logic Circuit |
| 13 | Review and Final Examination |