

SECURITY SYSTEMS – Course Syllabus

A.Y. 2025/2026

MASTER'S DEGREE PROGRAM IN SAFETY ENGINEERING AND CIVIL PROTECTION

SAPIENZA – UNIVERSITY OF ROME

1. ELEMENTS OF COMPUTER SCIENCE

- Information representation
- Computer architecture
- Software and operating systems

2. SECURITY SYSTEMS AND INSTALLATIONS

2.1 INTRODUCTION

- Physical security
- Electronic security
- Security systems: security and safety
- CEI standards

2.2 INTRUSION DETECTION SYSTEMS

- Introduction
- Components of intrusion detection systems
- Design and development:
 - Preliminary design
 - Executive design
 - Installation
 - Activation and testing
 - Maintenance
- Sensors:
 - Indoor sensors: magnetic contacts, panic switches, electromechanical switches, foil glass break sensors, piezoelectric sensors, inertial sensors, pressure sensors, passive infrared sensors, ultrasonic sensors, microwave sensors, acoustic sensors, infrasound sensors, dual technology sensors
 - Outdoor sensors: fluid pressure sensors, cable electromagnetic sensors, fiber optic cable sensors, capacitive sensors, geophone sensors, active infrared sensors, external microwave sensors, tensioned cable sensors, coaxial radiofrequency cable sensors, piezoelectric cable sensors, passive magnetic field sensors
- Interconnections:
 - Basic connection methods

- Advanced connection methods: hub systems, digital transmission systems, power line communication, radiofrequency systems
- Control units:
 - Control panel
 - Control unit
 - Power supply
 - Batteries
 - Disturbance protection
- Control devices:
 - Electromechanical keys
 - Electromechanical locks
 - Electronic keys
 - Keypads
- Alarm devices and transmission:
 - Voice telephone dialers
 - Digital telephone dialers

2.3 ACCESS CONTROL SYSTEMS

- Introduction
- Components of access control systems
- Design and development:
 - Area assessment and risk analysis
 - Access and flow analysis
 - System development
- Key devices:
 - Cards: magnetic stripe cards, magnetic spot cards, passive RFID cards, proximity cards, optical cards, holographic cards, infrared cards, barcode cards, QR code cards, punched cards, active proximity cards, radiofrequency devices, induction cards, smart cards
 - Biometric devices: fingerprint readers, handprint readers, signature readers, voice recognition, retina scanners, alphanumeric code input, NFC, BLE
- Readers:
 - Magnetic media readers
 - Optical media readers
 - Radiofrequency readers
- Access control panels:
 - Functionality and characteristics
- Interconnections:
 - Control and command connections
 - Communication connections: point-to-point and multipoint architectures
 - Power supply connections

Barriers:

Doors: locking mechanisms, locks: magnetic locks, electric locks

Turnstiles

Vestibules and revolving doors

External barriers

2.4 CLOSED-CIRCUIT TELEVISION (CCTV) SYSTEMS

- Introduction
- Analog, digital, and hybrid video surveillance
- Components of CCTV surveillance systems
- Design and development of CCTV systems

Elements of optics and television:

- The human eye
- Units of light measurement
- Calculation of light quantity reaching a capture device
- Color in television
- Color temperature and light sources
- Persistence and motion images

Advanced optics:

- Lenses
- Contrast and modulation transfer functions
- F and T numbers
- Depth of field
- Neutral density filters
- Lenses with manual, automatic, and motorized iris
- Electronically controlled automatic iris lenses
- Lens electronics
- Image and lens formats in CCTV
- Viewing angle
- Fixed focal length lenses
- Zoom lenses
- Back focus
- Optical accessories used in CCTV

General characteristics of TV systems:

- Basic concepts
- Video signal
- Color video signal
- Resolution: vertical, horizontal, color system resolution, video system resolution
- Television systems worldwide
- High-definition television

Cameras:

- Tube cameras
- CCD cameras
- CCD operation
- CCD control signals
- CCD sampling
- CMOS sensors
- Camera characteristics: sensitivity, minimum illumination, resolution, signal-to-noise ratio, dynamic range
- Color CCD cameras
- Thermal cameras
- Camera power supply

Monitors:

- Monitor sizes
- Monitor adjustments
- Monitor observation
- Gamma factor

- Interlaced and progressive scan
- Image frequency
- Frame rate
- LCD monitors
- Plasma monitors
- Projection monitors
- LED, OLED, QLED, MICROLED, AMOLED monitors
- Video formats
- High Dynamic Range (HDR)
- Touch screens
- Body-worn cameras and helmets for 3D applications

Auxiliary devices:

- Image processing devices: sequential video switchers, video matrices, quad video compressors, multiplexers, simple and duplex multiplexers, motion detection and video analysis, image memory, video printers
- Additional devices: pan/tilt mechanisms, dome pan/tilt, pan/tilt controllers, housings, lighting devices, ground potential correctors, lightning protection, line equalizers

Video recording devices:

- Operating principle
- VHS system
- Super VHS system
- Standard video recorder
- Time-lapse video recorder
- General recommendations
- Digital video
- Digital Video Recorders (DVR) and Network Video Recorders (NVR)

Video Compression and Digital Recording:

- Digital image compression: MPEG-1, MPEG-2, MPEG-4, MPEG-7, JPEG, Motion JPEG, H.261, H.262, H.263, H.264, wavelet algorithms
- Digital playback
- Digital VHS format
- DV format

Interconnections:

- Coaxial cable
- Twisted pair
- Other systems

Digital CCTV System Complements:

- Additional components for digital CCTV
- Design complements for CCTV systems

2.5 INTEGRATED SECURITY SYSTEMS

- Introduction
- Architecture of integrated security systems
- Building Automation
- Examples of operational integrated security systems

3. COMMUNICATION SECURITY

3.1 PRINCIPLES OF TELECOMMUNICATIONS

3.1.1 Introduction:

3.1.2 Physical Layer:

3.1.3 Data Link Physical Layer

3.1.4 MAC Sub-layer (Medium Access Control)

3.1.5 Network Layer:

3.1.6 Transport Layer:

3.1.7 Session Layer

3.1.8 Presentation Layer

3.1.9 Application Layer:

3.2 CRYPTOGRAPHY

3.2.1 Introduction

3.2.2 General Elements of Cryptography;

3.2.3 Data Encryption Standard (DES)

3.2.4 Other block ciphers

3.2.5 Cipher combinations

3.2.6 Pseudo-random sequence generators and stream ciphers

3.2.7 True random sequence generators;

3.2.8 One-way hash functions;

3.2.9 Advanced Encryption Standard (AES)

3.2.10 Public key algorithms

3.2.11 Public key algorithms for digital signatures

3.2.12 Key exchange algorithms

3.2.13 Practical Applications:

3.3 WIRED NETWORK SECURITY

3.3.1 Introduction

3.3.2 Firewalls;

3.3.3 S-HTTP protocol; Introduction to S-HTTP; Digital signatures in S-HTTP

3.3.4 SSL – Secure Socket Layer

3.3.5 Intrusion Detection;

3.3.6 Network Attacks

3.3.7 Authentication

3.3.8 Virtual Private Networks (VPNs

3.3.9 Key exchange in Kerberos systems;

3.3.10 Audit trails

3.3.11 Java language and related security issues

3.3.12 Web browser security;

3.3.13 Scripts and security issues

3.3.14 Computer viruses and security policies

4. HUMAN FACTOR IN SECURITY

- Basics of Psychology
- Basics of Social Engineering Psychology
- Security Psychology and Gender Identity

Bibliographic references for exam preparation:

- Lecture notes available on Classroom
- “Handbook of Communication Security”, F. Garzia, WIT Press, 2013
- “Psychology of Security, Emergency and Risk”, F. Borghini, F. Garzia, G. Borghini, A. Borghini, WIT Press, 2016