

**SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY**

**SAULT STE. MARIE, ON**

**COURSE OUTLINE**

**COURSE TITLE: COMMUNICATION SYSTEMS**

**CODE NO.: ELN680 SEMESTER: N/A**

**PROGRAM: ELECTRICAL MAINTENANCE TECHNICIAN  
(COMPUTER LITERACY)**

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**APPROVED: K. DeRosario Aug 26/97**  
DEAN BATE

**TOTAL CREDITS: 7**

**PREREQUISITE(S): N/A**

**LENGTH OF COURSE: 8 WEEKS @ 6 HOURS PER WEEK**

**TOTAL CREDIT HOURS: 48 HOURS**

Total credit hours

48

## **I. PHILOSOPHY/GOALS**

This course provides an overview of Sound and Video Systems, RF Transmission Lines and Antennas, VHF and UHF Voice and Data Radio Systems. The overview will be followed by the presentation of ASI site specific systems at the block diagram level, and the analysis of the schematic diagrams and detailed functioning of the above mentioned systems.

The following ASI-specific equipment will be treated in fair detail:

- Standard carbon-mike PA system and unitised Femco/Gaitronics PA system
- RCA TC-2000 and Panasonic WV-BP110 video cameras
- WV-CM1450 and ST-1000M colour monitors
- Vectran VR-10 Radio Control System
- Berlet 3000, 7000 and 8000 Radio Control System
- Femco Trolley Phone
- Radio Modems (Esteem, Arlan.)
- Other specific equipment, as requested, provided service manuals are available.

## **II. STUDENT PERFORMANCE OBJECTIVES**

Upon successful completion of this course, the student will be able to:

1. Understand the fundamentals of electronic communications, such as signal generation, amplification, modulation, demodulation, filtering, impedance matching, encoding, decoding, transmission lines, antennas and wave propagation.
2. Explain the block diagrams of the various voice/data/video/rf-control systems.
3. Read the schematic diagrams of the above mentioned communications systems.
4. Recall the trouble-shooting procedures of the various communications systems.
5. Understand the terminology and specifications of communications systems.

### III. TOPICS TO BE COVERED

#### 1. PAs and SOUND SYSTEMS

- 1.1 70-volt sound circuit.
- 1.2 Paging system.
- 1.3 Sound-distribution systems.
- 1.3 Methods for controlling volume.
- 1.4 Amplifier requirements.
- 1.5 Signal levels.
- 1.6 Amplifier specifications.
- 1.7 Microphones.
- 1.8 Speakers.
- 1.9 Speaker feed techniques.
- 1.10 150 W solid state, Carbon input amplifier
  - general description
  - specifications
  - installation
  - circuit analysis
  - maintenance
- 1.11 Unitised PA system
  - introduction
  - interconnection
  - dynamic microphone
  - speakers
  - amplifiers
  - muting
  - power supply module
  - installation
  - trouble shooting
- 1.12 Safe operation and maintenance of Sound Systems

#### 2. TROLLEY PHONES

- 2.1 General description
- 2.2 Circuit Analysis
  - Block diagrams
  - RF Coupler
  - Transmitter and receiver schematic
  - Power supply
- 2.3 PA system to Trolley Phone interface
  - circuit analysis
- 2.4 Maintenance and safety

### 3. VIDEO SYSTEMS

- 3.1 Monochrome and colour video signal
- 3.2 CCTV concept
- 3.3 Vidicon Camera (monochrome and colour)
  - Lens theory (auto-focus, auto-iris, depth of field.)
  - Internal construction
  - Electrode voltages
  - Focus, deflection, beam landing
  - Spectral response
  - Gamma correction
  - Colour Camera block diagram
- 3.4 Solid state, CCD camera (monochrome and colour)
- 3.5 Monochrome and Colour Video Monitor block diagrams
- 3.6 Picture tubes (monochrome and colour)
  - Construction
  - Electron gun
  - Anode high voltage
  - Electrostatic focus
  - Magnetic deflection
  - Static convergence
  - Dynamic convergence
  - Gamma correction
  - Pincushion and Barrel correction
- 3.7 NTSC standards for video and sync
- 3.8 Video Switch and RG59U cabling
- 3.9 Schematic diagram analysis of selected CCTV equipment (RCA, Panasonic)
- 3.10 Safety precautions (high voltage, implosion, X-ray protection)

### 4. RF TRANSMISSION

- 4.1 VHF/UHF transmitter block diagrams
- 4.2 VHF/UHF receiver block diagrams
- 4.3 Review of Modulation, frequency domain and time domain
- 4.4 RF circuits
  - Tuned circuits
  - Filtering, coupling and impedance matching
  - Amplifiers (signal and power)
  - Mixers, modulators
  - LC and Crystal oscillators
  - Frequency multipliers
  - $1/2 \lambda$  and  $1/4 \lambda$  antennas
  - Wave propagation

- 4.5 RF test and measuring equipment
  - RF mV meters and RF probes
  - Vector impedance meter
  - Spectrum analyzer
  - RF power meter

## 5. REMOTE CONTROL

- 5.1 Vectran VR-10 System general description
- 5.1 System specifications, bands and frequency allocations
- 5.2 Block diagram
- 5.3 Circuit description
- 5.4 RF alignment procedures
- 5.5 Test Point Data
- 5.6 Test equipment configuration
- 5.7 Schematic diagram analysis, Transmitter and Receiver
- 5.8 Pneumatics/Hydraulics interface
- 5.9 Encoding and decoding
- 5.10 Berlet Series 3000 general system description, bands and frequency allocations
  - The transmitter assembly
  - The receiver assembly
  - The Interface Rack assembly
  - Circuit description
- 5.11 Berlet Series 7000 general system description
  - Design features
  - Signal format, serial data, access code, program codes
  - Block diagrams
  - Switching Power Supplies
  - Troubleshooting
- 5.12 Berlet Series 8000 general system description
  - Transmitter block diagram
  - System access code settings
  - VHF transmitter module
  - UHF transmitter module
  - Batteries and battery chargers

## 6. RADIO MODEMS

- 6.1 General description
  - Technical specifications
- 6.2 Radio Path Considerations
- 6.3 Block diagrams
- 6.4 Set-up and trouble shooting

## IV. LEARNING ACTIVITIES

### SECTION 1: PAs and SOUND SYSTEMS

Upon successful completion of this section, the student will be able to

- Explain a block diagram of a typical central amplifier PA system.
- Explain the electrical specifications for an amplifier
- Explain the advantages of low impedance microphones
- Explain the characteristics of a carbon microphone
- Explain the characteristics of a typical PA speaker
- Explain impedance matching and power transfer
- Discuss the advantages of the various types of cables for PA systems
- Recall trouble shooting techniques
- Read the schematic diagram of a 150W PA amplifier
- Explain a block diagram of a typical Unitised PA System
- Describe the module interconnection methods
- Understand the electrical specifications for Handset and Speaker amplifiers
- Recall the characteristics of Dynamic microphones
- Discuss the multi-conductor cables used for unitised PA Systems
- Explain various cable faults (shorts, opens, burns, water.)
- Discuss the interconnection of the Sound System and the Trolley Phone
- Recall and use safe working procedures

### SECTION 2: TROLLEY PHONES

Upon successful completion of this section, the student will be able to

- Explain a block diagram of a typical Trolley Phone
- Explain the electrical specifications of a Trolley Phone
- Discuss typical hazards of the Trolley Phone system
- Discuss typical faults that occur in a Trolley Phone system
- Read the schematic diagrams of the Transmitter , Receiver , Power Supply and Coupler
- Discuss the Unitised Audio Coupler and the Coupler for the Central Amplifier System
- Explain the difference between the Audio Coupler and the RF Radio Coupler
- Be familiar with the technical specifications of the Femco Trolley Phone
- Recall maintenance procedures
- Recall typical hazards of the Trolley Phone System and safety considerations

### SECTION 3: VIDEO SYSTEMS

Upon successful completion of this section, the student will be able to

- Compare Baseband Video and Audio signals
- Explain the functioning of a Vidicon
- Explain the functioning of a CCD pickup element
- Understand lens theory and explain the basic features of lenses, such as aperture, auto iris, depth of field, zoom lenses, wide angle
- Explain a block diagram of a typical Monochrome CCTV system
- Explain a block diagram of a typical Colour CCTV system
- Understand Gamma correction
- Explain the construction and the functioning of a Picture Tube (monochrome and colour)
- Recall the functioning of Static and Dynamic convergence circuits
- Recall the functioning of Pincushion and Barrel distortion circuits
- Understand NTSC standards, relevant to Video systems
- Recall the characteristic impedance and the type of cabling used in video cabling (RG59U)
- Understand the requirements of a video switch (bandwidth and impedance matching)
- Read the prints of RCA and Panasonic cameras and monitors
- Recall safety precautions, when working with picture tubes and other video components
- Understand the mechanism of X-ray generation and the functioning of the Hold-Down circuit
- Recognize the difference between RG59U video cable, and RG62 coaxial cable used with Scintillation Counters (and carrying up to 1000V voltages)

### SECTION 4: RF TRANSMISSION

Upon successful completion of this section, the student will be able to

- Explain a block diagram of a typical VHF/UHF Transmitter
- Explain a block diagram of a typical VHF/UHF Receiver
- Recall the various methods of Analog Modulation
- Understand the functioning of typical RF communications circuits, such as tuned circuits, filtering, coupling, impedance matching circuits, mixers, modulators, oscillators, frequency multipliers, signal amplifiers, power amplifiers and antennas.
- Recall the definition of wave polarisation as a function of antenna position
- Understand antenna gain and directivity patterns
- Understand standing waves, travelling waves, reflected waves, VSWR,  $\Gamma$
- Recall the properties of  $1/4 \lambda$  and  $1/2 \lambda$  radiators
- Identify typical RF cable connectors, such as Type F, BNC, UHF, Type N, SMA
- Recognize a variety of coaxial cables and their RG designation
- Understand the difference between a DVM and an RF mV meter

