## Academic Program Description Form

**University Name:** Diyala

**Faculty/Institute:** College of Engineering

**Scientific Department:** Communications Engineering

**Academic or Professional Program Name:** Bachelor

**Final Certificate Name:** bachelor of Science in Communications Engineering

**Academic System:** Course

**Description Preparation Date:** 6 – 7 – 2025

**File Completion Date:** 6 – 7 – 2025

**Signature:**

**Head of Department Name:** Assit. Prof. Dr. Mohammed S. Saleh

**Date:** 6 – 7 – 2025

**Signature:**

**Scientific Associate Name:** prof. Dr. Jabbar Kasim Jabbar

**Date:** 6 – 7 – 2025

**The file is checked by:** Assist Prof Dr. Salah M. Farhan

**Department of Quality Assurance and University Performance**

**Director of the Quality Assurance and University Performance Department:**

**Date:** 6 – 7 – 2025

**Signature:**

**Approval of the Dean**

prof. Dr. Anees A. Khadom

## 1. Program Vision

The department going to develop the curriculum in line with modern scientific developments in the field of communications engineering in addition to completing all the special requirements of scientific laboratories in the department. We seek to improve the staffed of teaching by dispatching members of Department of postgraduate in both inside and outside the country, and configure the appropriate conditions for scientific research in order to get Degrees required to be a Department able to compete in its own right and marked with the corresponding sections only local of which or the Arab and international Our ambitions We aspire to open graduate studies for a master's certificate in the disciplines of engineering various communication to be Department of scientific expertise to attract local and international center of which to open the horizons of cooperation through conferences, consulting, training, scientific research and development through broad and orderly opening to the community.

## 2. Program Mission

Expanding educational base and their applications in modern field of telematics and communications across both the international network and devices and cellular all advanced communication systems form that meets the need of institutions, both belonging to the state or the private sector through education, training and rehabilitation input from Human Resources (students) and make them able to deal with modern techniques and working in different institutions efficiently and effectively serve our dear country march.

## 3. Program Objectives

Teach students studying in the department on techniques required in all areas of modern communication systems and their applications in scientific and field state departments. Qualify graduates capable of working in government departments and the private sector engineering staff specialist efficiently and effectively. Contribute to provide an advanced level of related activities and the realization of the institutions experience and lead to the fulfillment of their need of human resources in order to achieve their success and the evolution and continuation.

## 4. Program Accreditation

None

## 5. Other external influences

None

## 6. Program Structure

| Program Structure | Number of Courses | Credit hours | Percentage | Reviews* |
|---|---|---|---|---|
| Institution requirements | 5 | 6 | 4.24% | |
| College requirements | 9 | 20 | 14.20% | |
| Department requirements | 46 | 115 | 81.56% | |
| Summer Training | | | | Graduation Requirements |
| Others | | | | |

## 7. Program Description

| Course Name | Course Code | Level/Year | Credit Hours | |
|---|---|---|---|---|
| | | | Practical | Theory |
| Democracy & human Rights | **U 101** | Second - First | - | 2 |
| Workshop skills | **COE 107** | Second - First | 3 | - |
| Computer skills | **U 103** | First - First | 3 | 1 |
| English Language | **U 104** | First - First | - | 2 |
| Engineering Drawing | **COE 106** | First - First | 3 | - |
| Mathematics -I | **E 101** | First - First | - | 4 |
| Mathematics -II | **E 102** | Second - First | - | 4 |
| Electronic Physics | **COE 104** | Second - First | - | 4 |
| C++ Programming | **COE 105** | Second - First | 3 | 1 |
| Digital Techniques | **COE103** | First - First | 2 | 4 |
| **Electrical Engineering Fundamentals I** | **COE 101** | First - First | 2 | 6 |
| **Electrical Engineering Fundamentals II** | **COE102** | Second - First | 2 | 6 |
| **Arabic Language** | **U 108** | Second - First | - | 2 |
| **Signals and systems** | **COE 201** | First - Second | 2 | 3 |
| **Applied mathematics I** | **COE 202** | First -Second | - | 3 |
| **Electrical circuits** | **COE 203** | First - Second | 2 | 4 |
| **Electronic I** | **COE 204** | First - Second | 2 | 3 |
| **MatLab Programming** | **COE 205** | First - Second | 2 | 2 |

| | | | | |
|---|---|---|---|---|
| **Electromagnetic fields I** | **COE 206** | First - Second | - | 3 |
| **Analog communication** | **COE 207** | Second- Second | 2 | 3 |
| **Applied Mathematics II** | **COE 208** | Second- Second | - | 3 |
| **Electronic II** | **COE 209** | Second- Second | 2 | 3 |
| **Probability and random processing** | **COE 210** | Second -Second | - | 5 |
| **Electromagnetic fields II** | **COE 211** | Second -Second | - | 3 |
| **Computer 2** | **UD23** | Second -Second | 2 | 1 |
| **English Language 2** | UD21 | Second -Second | - | 2 |
| **Arabic Language 2** | UD22 | Second -Second | - | 2 |
| **Ba'ath Regime Crimes in Iraq** | UD24 | First -Second | - | 2 |
| Engineering Economy | **E301** | First - Third | - | 2 |
| Engineering Analysis | **COE301** | First - Third | - | 2 |
| Digital Communication I | **COE302** | First - Third | 2 | 3 |
| Antenna Theory and Design | **COE303** | First - Third | 2 | 3 |
| Digital Signal Processing | **COE304** | First - Third | 2 | 3 |
| Microcontroller and DSP Systems | **COE305** | First - Third | 2 | 2 |
| Communication Electronics -I | **COE306** | First - Third | 2 | 3 |
| Optical Communication Systems | **COE307** | First - Third | - | 2 |
| Detection and Estimation Theory | **COE308** | Second -Third | - | 3 |
| Digital Communication II | **COE309** | Second -Third | 2 | 3 |
| Image Processing | **COE310** | Second -Third | 2 | 2 |
| Information Theory | **COE311** | Second -Third | - | 3 |
| Radar Systems | **COE312** | Second -Third | 2 | 2 |
| Computer Networks | **COE313** | Second -Third | 2 | 2 |
| Waves Propagation | **COE314** | Second -Third | - | 2 |
| Communication Electronics -II | **COE315** | Second -Third | 2 | 2 |
| Engineering Profession Ethics | **E401** | First - Fourth | - | 1 |
| Graduation Project | **E402** | Fourth | 8 | - |
| Microwave Engineering-I | **COE401** | First - Fourth | 2 | 3 |
| Modern Communication Systems | **COE402** | First - Fourth | - | 3 |
| Cellular Mobile Networks | **COE403** | First - Fourth | - | 2 |
| Cryptography for Communication Systems | **COE404** | First - Fourth | - | 2 |
| Satellite Communication Systems | **COE405** | First - Fourth | - | 2 |
| Microwave Engineering-II | **COE406** | Second - Fourth | 2 | 3 |
| Global Positioning Systems | **COE407** | Second - Fourth | - | 2 |
| Multimedia Communication | **COE408** | Second - Fourth | - | 2 |
| Telecom Switching Systems | **COE409** | Second - Fourth | - | 2 |
| Television and Broadcasting Systems | **COE410** | Second - Fourth | - | 2 |

## 8. Expected learning outcomes of the program

**Knowledge**

A. Cognitive goals

A1. - Understanding and teaching the student the principles of how signal work and how to deal with communication algorithms.

A2- Enabling students to obtain knowledge and understanding in working on and designing signal and system .

A3- The student understands the methods of forming signal and system parts and their interconnection.

A4- Enabling students to obtain knowledge and understanding of designing everything related to optical signal and system.

A5- Enabling students to obtain knowledge and understanding of diagnosing faults and maintaining various signal and system devices.

A6- The student understands the foundations of solving communication problems, cellular networks, and etc.

**Skills**

A. The skills goals special to the program.

B1 - Explanation of communication principles topics by specialists in the subject, with an emphasis on the use of mathematics as a basis for understanding and learning.

B2 - Providing them with skills to solve practical problems related to various communication systems and algorithms for addressing and solving technical problems in various fields of Communication engineering.

B3 – Obtaining experience to explore and develop communication systems and its algorithms.

**Ethics**

A. Affective and value goals

C1- Enabling students to think and analyze topics related to the engineering framework, such as various logical circuits.

C2- Enabling students to think and analyze topics related to Communication systems related to the engineering framework.

C3- Enabling students to think and analyze topics related to solving practical problems.

## 9. Teaching and Learning Strategies

 Providing students with the basics, additional topics, and field experiences related to the outcomes of thinking and analysis.

 Forming discussion circles during or outside lectures to discuss scientific engineering topics that require thinking and analysis.

 Asking students a set of thinking questions during lectures, such as (what, how,

when, why) for specific topics.

## 10. Evaluation methods

- Daily exams with practical and scientific questions.
- Participation marks for difficult competition questions among students.
- Assigning grades to homework assignments and reports assigned to them.
- Semester exams for the curriculum in addition to the final exam.

## 11. Faculty

### Faculty Members

| Academic Rank | Specialization | | Special Requirements/Skills (if applicable) | | Number of the teaching staff | |
|---|---|---|---|---|---|---|
| | General | Special | | | Staff | Lecturer |
| Professor | Electronic & communications | Communications | | | 1 | |
| Assist. Prof. | Communications | Communications techniques | | | 1 | |
| Assist. Prof. | Electronic & communications | Communications | | | 3 | |
| Assist. Prof. | Electric Eng. | Electronic & communications | | | 3 | |
| Assist. Prof. | Physics | Electro=optics | | | 1 | |
| Assist. Prof. | Physics | Nano technology | | | 1 | |
| Assist. Prof. | Communications | Communications | | | 1 | |
| Assist. Prof. | Info. & Comm. Eng. | Image processing | | | 1 | |
| Assist. Prof. | Elect. & Electronic Eng. | Communications | | | | 1 |
| Assist. Prof. | Electro-optics and laser | Optoelectronics | | | 1 | |
| Lecturer | Elect. & Electronic Eng. | Electronics | | | 1 | 1 |
| Lecturer | Communications | Communications | | | 1 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Assist. Lecturer | Communications | Communications | | | 3 | |
| Assist. Lecturer | Elect. & Electronic Eng. | Electronics | | | 1 | |
| Assist. Lecturer | Electronic & communications | Communications | | | 2 | |
| Assist. Lecturer | Electric Eng. | Electronic & communications | | | 1 | |

## Professional Development

**Mentoring new faculty members**

Faculty members are instructed to hold regular meetings and review questionnaires received from students with the Scientific Committee.

**Professional development of faculty members**

The teaching staff undergoes development through training, workshops, and seminars. Progress is evaluated by subject performance.

## 12. Acceptance Criterion

According to the rules and regulations of Ministry of Higher Education and Scientific Research.

## 13. The most important sources of information about the program

- College website.
- The department's website and contact the department by email.

## 14. Program Development Plan

- The courses are updated annually to keep up with developments of the world.
- The laboratories are also updated under academic curricula.
- Additionally, postgraduate programs are now being offered.

| Program Skills Outline | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Required program Learning outcomes | | | | | | | | | | | |
| Year/Level | Course Code | Course Name | Basic or optional | Knowledge | | | | Skills | | | | Ethics | | | |
| | | | | A1 | A2 | A3 | A4 | B1 | B2 | B3 | B4 | C1 | C2 | C3 | C4 |
| Fourth /1st | **Cellular Mobile Networks** | **COE403** | Basic | √ | √ | √ | √ | √ | √ | √ | | √ | √ | √ | |
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- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

# Course Description Form

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|---|
| 1. Course Name: Cellular Mobile Networks |
| |
| 2. Course Code: COE403 |
| |
| 3. Semester / Year: 1st / 4th |
| |
| 4. Description Preparation Date: |
| 24-4-2024 |
| 5. Available Attendance Forms: mandatory |
| None |
| 6. Number of Credit Hours (Total) / Number of Units (Total) : 30 |
| |
| 7. Course administrator's name (mention all, if more than one name) |
| Lecture :Name : wisam hayed mahdi Email: wisam_haider@uodiyala.edu.iq ..... ..... ..... |
| 8. Course Objectives |

| | |
|---|---|
| **Course Objectives** | The student learn Cellular Overview: History of Mobile Communications, Evolution of Cellular: from pre-1G to 4G, Licensing Issues. The student study Cellular Concept and Design: Hexagons and Channelization. Also, he will learn concepts Handoff, Interference vs. Capacity, Trunking, Grade of Service, Erlang Computations Cell Splitting and Sectoring. Mobile Signals Propagation: Basic Equations and Mechanisms, Free Space Loss, Flat Earth Loss, Diffraction and Scattering, Longley-Rice and OH Loss Models, Okamura-Hata, COST-231, and Extensions, Walfisch, Ikagami, and Bertoni. The student study Small Scale Fading and Multipath: Doppler Shift, Impulse Response and the Cellular Channel, Time Dispersion and Flat vs Frequency Selective Fading, Coherence Time and Fast vs Slow Fading, Rayleigh and |

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| | Ricean Distributions, Fading Statistics. At last, the student learn Evolution to Modern Systems: Diversity and Downtilting, CDMA and Processing Gain, CDMA Capacity Calculations, OFDMA Concepts, LTE and Frequency Reuse, MIMO and Beamforming. |

## 9. Teaching and Learning Strategies

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|---|---|
| **Strategy** | The Lecture gives detailed theoretical lectures.<br><br>The Lecture requests periodic reports and presentations on the basic topics of the subject. |

## 10. Course Structure

| Week | Hours | Required Learning Outcomes | Unit or subject name | Learning method | Evaluation method |
|---|---|---|---|---|---|
| First | 2 | The student learns an introduction to Cellular Overview History of Mobile Communications, Evolution of Cellular: from pre-1G to 4G, Licensing Issues | Cellular Overview: History of Mobile Communications, Evolution of Cellular: from pre-1G to 4G, Licensing Issues. | Lectures, PDF, power point and Video | Daily exams + practical experiments + monthly exams |
| Second | 2 | The student learns an introduction to Cellular Overview History of Mobile Communications, Evolution of Cellular: from pre-1G to 4G, Licensing Issues | Cellular Overview: History of Mobile Communications, Evolution of Cellular: from pre-1G to 4G, Licensing Issues. | Lectures, PDF, power point and Video | Daily exams + practical experiments + monthly exams |
| Third | 2 | The student study deeply Cellular Concept and Design: Hexagons and Channelization. Handoff, Interference vs. Capacity, Trunking, Grade of Service, Erlang Computations Cell Splitting and Sectoring. Mobile Signals Propagation: Basic Equations and Mechanisms, Free Space Loss, Flat Earth Loss, Diffraction and Scattering, Longley-Rice and OH Loss Models, Okamura-Hata, COST-231, and Extensions, Walfisch, Ikagami, and Bertoni. | Cellular Concept and Design: Hexagons and Channelization. Handoff, Interference vs. Capacity, Trunking, Grade of Service, Erlang Computations Cell Splitting and Sectoring. Mobile Signals Propagation: Basic Equations and Mechanisms, Free Space Loss, Flat Earth Loss, Diffraction and Scattering, Longley-Rice and OH Loss Models, Okamura-Hata, COST-231, and Extensions, Walfisch, Ikagami, and Bertoni. | Lectures, PDF, power point and Video | Daily exams + practical experiments + monthly exams |

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| Fourth | 2 | The student study deeply Cellular Concept and Design: Hexagons and Channelization. Handoff, Interference vs. Capacity, Trunking, Grade of Service, Erlang Computations Cell Splitting and Sectoring. Mobile Signals Propagation: Basic Equations and Mechanisms, Free Space Loss, Flat Earth Loss, Diffraction and Scattering, Longley-Rice and OH Loss Models, Okamura-Hata, COST-231, and Extensions, Walfisch, Ikagami, and Bertoni. | Cellular Concept and Design: Hexagons and Channelization. Handoff, Interference vs. Capacity, Trunking, Grade of Service, Erlang Computations Cell Splitting and Sectoring. Mobile Signals Propagation: Basic Equations and Mechanisms, Free Space Loss, Flat Earth Loss, Diffraction and Scattering, Longley-Rice and OH Loss Models, Okamura-Hata, COST-231, and Extensions, Walfisch, Ikagami, and Bertoni. | Lectures, PDF, power point and Video | Daily exams + practical experiments + monthly exams |
| Fifth | 2 | The student study deeply Cellular Concept and Design: Hexagons and Channelization. Handoff, Interference vs. Capacity, Trunking, Grade of Service, Erlang Computations Cell Splitting and Sectoring. Mobile Signals Propagation: Basic Equations and Mechanisms, Free Space Loss, Flat Earth Loss, Diffraction and Scattering, Longley-Rice and OH Loss Models, Okamura-Hata, COST-231, and Extensions, Walfisch, Ikagami, and Bertoni. | Cellular Concept and Design: Hexagons and Channelization. Handoff, Interference vs. Capacity, Trunking, Grade of Service, Erlang Computations Cell Splitting and Sectoring. Mobile Signals Propagation: Basic Equations and Mechanisms, Free Space Loss, Flat Earth Loss, Diffraction and Scattering, Longley-Rice and OH Loss Models, Okamura-Hata, COST-231, and Extensions, Walfisch, Ikagami, and Bertoni. | Lectures, PDF, power point and Video | Daily exams + practical experiments + monthly exams |
| Sixth | 2 | The student study deeply Cellular Concept and Design: Hexagons and Channelization. Handoff, Interference vs. Capacity, Trunking, Grade of Service, Erlang Computations Cell Splitting and Sectoring. Mobile Signals Propagation: Basic Equations and Mechanisms, Free Space | Cellular Concept and Design: Hexagons and Channelization. Handoff, Interference vs. Capacity, Trunking, Grade of Service, Erlang Computations Cell Splitting and Sectoring. Mobile Signals Propagation: Basic Equations and Mechanisms, Free Space Loss, Flat Earth Loss, | Lectures, PDF, power point and Video | Daily exams + practical experiments + monthly exams |

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|---|---|---|---|---|---|
| | | Loss, Flat Earth Loss, Diffraction and Scattering, Longley-Rice and OH Loss Models, Okamura-Hata, COST-231, and Extensions, Walfisch, Ikagami, and Bertoni. | Diffraction and Scattering, Longley-Rice and OH Loss Models, Okamura-Hata, COST-231, and Extensions, Walfisch, Ikagami, and Bertoni. | | |
| Seventh | 2 | The student study deeply Cellular Concept and Design: Hexagons and Channelization. Handoff, Interference vs. Capacity, Trunking, Grade of Service, Erlang Computations Cell Splitting and Sectoring. Mobile Signals Propagation: Basic Equations and Mechanisms, Free Space Loss, Flat Earth Loss, Diffraction and Scattering, Longley-Rice and OH Loss Models, Okamura-Hata, COST-231, and Extensions, Walfisch, Ikagami, and Bertoni. | Cellular Concept and Design: Hexagons and Channelization. Handoff, Interference vs. Capacity, Trunking, Grade of Service, Erlang Computations Cell Splitting and Sectoring. Mobile Signals Propagation: Basic Equations and Mechanisms, Free Space Loss, Flat Earth Loss, Diffraction and Scattering, Longley-Rice and OH Loss Models, Okamura-Hata, COST-231, and Extensions, Walfisch, Ikagami, and Bertoni. | Lectures, PDF, power point and Video | Daily exams + practical experiments + monthly exams |
| Eighth | 2 | The student will recognize on Small Scale Fading and Multipath which are : Doppler Shift, Impulse Response and the Cellular Channel, Time Dispersion and Flat vs Frequency Selective Fading, Coherence Time and Fast vs Slow Fading, Rayleigh and Ricean Distributions, Fading Statistics. | Small Scale Fading and Multipath: Doppler Shift, Impulse Response and the Cellular Channel, Time Dispersion and Flat vs Frequency Selective Fading, Coherence Time and Fast vs Slow Fading, Rayleigh and Ricean Distributions, Fading Statistics. | Lectures, PDF, power point and Video | Daily exams + practical experiments + monthly exams |
| Ninth | 2 | The student will recognize on Small Scale Fading and Multipath which are : Doppler Shift, Impulse Response and the Cellular Channel, Time Dispersion and Flat vs Frequency Selective Fading, Coherence Time and Fast vs Slow Fading, Rayleigh and Ricean | Small Scale Fading and Multipath: Doppler Shift, Impulse Response and the Cellular Channel, Time Dispersion and Flat vs Frequency Selective Fading, Coherence Time and Fast vs Slow Fading, Rayleigh and Ricean Distributions, Fading Statistics. | Lectures, PDF, power point and Video | Daily exams + practical experiments + monthly exams |

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|---|---|---|---|---|---|
| | | Distributions, Fading Statistics. | | | |
| Tenth | 2 | The student will recognize on Small Scale Fading and Multipath which are : Doppler Shift, Impulse Response and the Cellular Channel, Time Dispersion and Flat vs Frequency Selective Fading, Coherence Time and Fast vs Slow Fading, Rayleigh and Ricean Distributions, Fading Statistics. | Small Scale Fading and Multipath: Doppler Shift, Impulse Response and the Cellular Channel, Time Dispersion and Flat vs Frequency Selective Fading, Coherence Time and Fast vs Slow Fading, Rayleigh and Ricean Distributions, Fading Statistics. | Lectures, PDF, power point and Video | Daily exams + practical experiments + monthly exams |
| Eleventh | 2 | Also our students will study the Evolution to Modern Systems is : Diversity and Downtilting, CDMA and Processing Gain, CDMA Capacity Calculations, OFDMA Concepts, LTE and Frequency Reuse, MIMO and Beamforming. | Evolution to Modern Systems: Diversity and Downtilting, CDMA and Processing Gain, CDMA Capacity Calculations, OFDMA Concepts, LTE and Frequency Reuse, MIMO and Beamforming. | Lectures, PDF, power point and Video | Daily exams + practical experiments + monthly exams |
| Twelfth | 2 | Also our students will study the Evolution to Modern Systems is : Diversity and Downtilting, CDMA and Processing Gain, CDMA Capacity Calculations, OFDMA Concepts, LTE and Frequency Reuse, MIMO and Beamforming. | Evolution to Modern Systems: Diversity and Downtilting, CDMA and Processing Gain, CDMA Capacity Calculations, OFDMA Concepts, LTE and Frequency Reuse, MIMO and Beamforming. | Lectures, PDF, power point and Video | Daily exams + practical experiments + monthly exams |
| Thirteenth | 2 | Also our students will study the Evolution to Modern Systems is : Diversity and Downtilting, CDMA and Processing Gain, CDMA Capacity Calculations, OFDMA Concepts, LTE and Frequency Reuse, MIMO and Beamforming. | Evolution to Modern Systems: Diversity and Downtilting, CDMA and Processing Gain, CDMA Capacity Calculations, OFDMA Concepts, LTE and Frequency Reuse, MIMO and Beamforming. | Lectures, PDF, power point and Video | Daily exams + practical experiments + monthly exams |

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| Fourteenth | 2 | Also our students will study the Evolution to Modern Systems is : Diversity and Downtilting, CDMA and Processing Gain, CDMA Capacity Calculations, OFDMA Concepts, LTE and Frequency Reuse, MIMO and Beamforming. | Evolution to Modern Systems: Diversity and Downtilting, CDMA and Processing Gain, CDMA Capacity Calculations, OFDMA Concepts, LTE and Frequency Reuse, MIMO and Beamforming. | Lectures, PDF, power point and Video | Daily exams + practical experiments + monthly exams |

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## 11. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports.....etc

## 12. Learning and Teaching Resources

| | |
|---|---|
| Required textbooks (curricular books, if any) | |
| Main references (sources) | |
| Recommended books and references (scientific journals, reports…) | |
| Electronic References, Websites | |