



## Teaching Guide

| Teaching Guide      |                                                                                                                                                                                                        |        |                       |           |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------|-----------|
| Identifying Data    |                                                                                                                                                                                                        |        |                       | 2022/23   |
| Subject (*)         | Networks and Communications                                                                                                                                                                            |        | Code                  | 631G02366 |
| Study programme     | Grao en Tecnoloxías Mariñas                                                                                                                                                                            |        |                       |           |
| Descriptors         |                                                                                                                                                                                                        |        |                       |           |
| Cycle               | Period                                                                                                                                                                                                 | Year   | Type                  | Credits   |
| Graduate            | 2nd four-month period                                                                                                                                                                                  | Third  | Optional              | 6         |
| Language            | SpanishGalicianEnglish                                                                                                                                                                                 |        |                       |           |
| Teaching method     | Face-to-face                                                                                                                                                                                           |        |                       |           |
| Prerequisites       |                                                                                                                                                                                                        |        |                       |           |
| Department          | Enxeñaría de Computadores                                                                                                                                                                              |        |                       |           |
| Coordinador         | Bregains Rodriguez, Julio Claudio                                                                                                                                                                      | E-mail | julio.bregains@udc.es |           |
| Lecturers           | Bregains Rodriguez, Julio Claudio                                                                                                                                                                      | E-mail | julio.bregains@udc.es |           |
| Web                 | campusvirtual.udc.es                                                                                                                                                                                   |        |                       |           |
| General description | In this course the student is expected to acquire knowledge about the hardware, software and protocols of the network and communications systems, both of the ship and of part of the port facilities. |        |                       |           |

## Study programme competences

| Code | Study programme competences                                                                                                                                                                                                                                                   |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A1   | CE1 - Capacidade para a realización de inspeccións, medicións, valoracións, taxacións, peritacións, estudos, informes, planos de labores e certificacións nas instalacións do ámbito da súa especialidade.                                                                    |
| A2   | CE2 - Capacidade para a dirección, organización e operación das actividades obxecto das instalacións marítimas no ámbito da súa especialidade.                                                                                                                                |
| A3   | CE3 - Capacidade para o manexo de especificacións, regulamentos e normas de obrigado cumprimento.                                                                                                                                                                             |
| A11  | CE11 - Observar prácticas de seguridade no traballo, no ámbito da súa especialidade.                                                                                                                                                                                          |
| A16  | CE16 - Ensamblar e realizar tarefas básicas de mantemento e reparación de equipos informáticos. Instalar e manexar sistemas operativos e aplicacións informáticas. Instalar e realizar as tarefas básicas de xestión de redes de ordenadores, no ámbito da súa especialidade. |
| A18  | CE18 - Redacción e interpretación de documentación técnica.                                                                                                                                                                                                                   |
| A19  | CE19 - Coñecer as características e limitacións dos materiais utilizados para a reparación de buques e equipos.                                                                                                                                                               |
| A59  | CE34 - Utilizar os sistemas de comunicación interna                                                                                                                                                                                                                           |
| A64  | CE54 - Supervisar o funcionamento dos sistemas de control automático da máquina propulsora principal e sistemas auxiliares                                                                                                                                                    |
| A67  | CE57 - Facer funcionar os ordenadores e redes informáticas a bordo dos buques                                                                                                                                                                                                 |
| A68  | CE58 - Manter e reparar o equipo eléctrico e electrónico                                                                                                                                                                                                                      |
| A70  | CE60 - Manter e reparar os equipos de navegación da ponte e dos sistemas de comunicación do buque                                                                                                                                                                             |
| B1   | CT1 - Capacidad para gestionar los propios conocimientos y utilizar de forma eficiente técnicas de trabajo intelectual                                                                                                                                                        |
| B2   | CT2 - Resolver problemas de forma efectiva.                                                                                                                                                                                                                                   |
| B4   | CT4 - Traballar de forma autónoma con iniciativa.                                                                                                                                                                                                                             |
| B5   | CT5 - Traballar de forma colaboradora.                                                                                                                                                                                                                                        |
| B6   | CT6 - Comportarse con ética e responsabilidade social como cidadán e como profesional.                                                                                                                                                                                        |
| B7   | CT7 - Capacidade para interpretar, seleccionar e valorar conceptos adquiridos noutras disciplinas do ámbito marítimo, mediante fundamentos físico-matemáticos.                                                                                                                |
| B9   | CT9 - Capacidade para a aprendizaxe de novos métodos e teorías, que lle doten dunha gran versatilidade para adaptarse a novas situacións.                                                                                                                                     |
| B11  | CT11 - Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos habilidades e destrezas.                                                                                               |
| C2   | C2 - Dominar a expresión e a comprensión de forma oral e escrita dun idioma estranxeiro.                                                                                                                                                                                      |
| C3   | C3 - Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.                                                                                          |
| C7   | C7 - Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.                                                                                                                                                                                         |



|     |                                                                                                                                                                                                                                 |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C8  | C8 - Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.                                                                              |
| C9  | CB1 - Demostrar que posúen e comprenden coñecementos na área de estudo que parte da base da educación secundaria xeneral, e que inclúe coñecementos procedentes da vangardia do seu campo de estudo                             |
| C10 | CB2 - Aplicar os coñecementos no seu traballo ou vocación dunha forma profesional e poseer competencias demostrables por medio da elaboración e defensa de argumentos e resolución de problemas dentro da área dos seus estudos |
| C11 | CB3 - Ter a capacidade de reunir e interpretar datos relevantes para emitir xuícos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética                                                      |
| C12 | CB4 - Poder transmitir información, ideas, problemas e solucións a un público tanto especializado como non especializado.                                                                                                       |
| C13 | CB5 - Ter desenvolvido aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores con un alto grao de autonomía.                                                                                          |

| Learning outcomes                                                                                                                           |  |                             |         |
|---------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------|---------|
| Learning outcomes                                                                                                                           |  | Study programme competences |         |
| Basic knowledge of data transmission concepts and on-board computer network architecture.                                                   |  | A1                          | B2 C2   |
|                                                                                                                                             |  | A2                          | B4 C3   |
|                                                                                                                                             |  | A3                          | B5 C7   |
|                                                                                                                                             |  | A11                         | B6 C8   |
|                                                                                                                                             |  | A18                         | B7 C9   |
|                                                                                                                                             |  | A19                         | B9 C10  |
|                                                                                                                                             |  |                             | B11 C11 |
|                                                                                                                                             |  |                             | C12     |
|                                                                                                                                             |  |                             | C13     |
| To know the fundamental technical aspects of data transmission installations and communications networks for a good professional operation. |  | A1                          | B1 C2   |
|                                                                                                                                             |  | A2                          | B2 C3   |
|                                                                                                                                             |  | A3                          | B4 C10  |
|                                                                                                                                             |  | A11                         | B5 C11  |
|                                                                                                                                             |  | A16                         | B6 C12  |
|                                                                                                                                             |  | A18                         | B7 C13  |
|                                                                                                                                             |  | A19                         | B9      |
|                                                                                                                                             |  | A59                         | B11     |
|                                                                                                                                             |  | A64                         |         |
|                                                                                                                                             |  | A67                         |         |
| To know the most commonly used communications protocols, and being able to interpret and implement them.                                    |  | A3                          | B1 C2   |
|                                                                                                                                             |  | A18                         | B2 C3   |
|                                                                                                                                             |  | A67                         | B4 C7   |
|                                                                                                                                             |  |                             | B5 C8   |
|                                                                                                                                             |  |                             | B6      |

| Contents                                          |                                                                                                                                                                                                                                             |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topic                                             | Sub-topic                                                                                                                                                                                                                                   |
| 1: Basic concepts of networks and communications. | Networks: definition and classification. Fundamentals of communications.<br>Fundamentals of the ISO OSI model: lower layers. Ethernet standard. Switches and routers. TCP/IP protocols. Network addressing and subnets. Data encapsulation. |



|                                          |                                                                                                                                                                                                                                                          |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2. More advanced concepts on telematics. | Data transmission. Error detection and control. Physical and logical topology. Circuit switching and packet switching. Coding and packaging. Protocols. Redundancy, reliability. Measurement parameters.                                                 |
| 3. OSI reference models.                 | Description of the 5-layer OSI model. Physical, link and network layers. Transport layer and higher layers. Internet. Protocol stacks.                                                                                                                   |
| 4. Wired network.                        | Transmission media. Connectors. Protocols. Switch, hub, router, modem. Protocol converter, bridge. Mass memory, node. Structured cabling.                                                                                                                |
| 5. Wireless network.                     | WiFi networks, 802.11 x protocols. Configuration of a WiFi. Sensor networks. PANs: Bluetooth, 802.15.4 WiMAX.                                                                                                                                            |
| 6. Marine buses and networks.            | Point to point and multipoint protocols. Null modem, RS232C, RS422. USB. CanBus and variants. NMEA standards. SeaTalk. Industrial local area networks: Profibus. Industrial Ethernet. Power line transmission (PLCs). TCP/IP. IP telephony (VoIP, ToIP). |
| 7. Marine networks.                      | Monitoring and control networks. Management networks. Interconnection of bridge equipment. Interconnection of networks on the ship. Internet access and external networks. Satellite data connections. Regulations: entities and main standards.         |

| Planning                                                                                                                        |                                                                                    |                      |                               |             |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------|-------------------------------|-------------|
| Methodologies / tests                                                                                                           | Competencies                                                                       | Ordinary class hours | Student's personal work hours | Total hours |
| Guest lecture / keynote speech                                                                                                  | A19 B1 B6 B7 B9 C7 C8 C11                                                          | 21                   | 41                            | 62          |
| Problem solving                                                                                                                 | A18 B2 B4 B5 B7 B9 B11 C2 C3 C7 C8 C9 C10 C11 C13                                  | 7                    | 21                            | 28          |
| Laboratory practice                                                                                                             | A1 A2 A3 A11 A16 A18 A67 A68 A70 B2 B4 B5 B6 B7 B9 B11 C2 C7 C8 C9 C10 C11 C12 C13 | 7                    | 21                            | 28          |
| ICT practicals                                                                                                                  | A18 A67 B1 B2 B4 B5 B6 B7 B9 B11 C2 C3 C7 C8 C9 C10 C11 C12 C13                    | 7                    | 21                            | 28          |
| Mixed objective/subjective test                                                                                                 | A3 A18 A19 A59 A64 B1 B2 B4 B6 B7 B11 C2 C3 C7 C8 C9 C10 C11 C12 C13               | 3                    | 0                             | 3           |
| Personalized attention                                                                                                          |                                                                                    | 1                    | 0                             | 1           |
| (*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. |                                                                                    |                      |                               |             |

| Methodologies                  |                                                                                                                                                                                           |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Methodologies                  | Description                                                                                                                                                                               |
| Guest lecture / keynote speech | The professor will develop the theoretical contents of the course, under a practical approach, relating whenever possible the theoretical contents with real examples on ships and boats. |
| Problem solving                | Students will learn how to formulate and solve, with the use of ICT tools, representative exercises or works formulated by the teacher.                                                   |
| Laboratory practice            | Practices to be developed: interconnection, wiring and basic configuration of computer networks and devices, using software tools or directly by means of specific measuring equipment.   |



|                                 |                                                                                                                                             |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| ICT practicals                  | Practices to be developed: simulation of the design, wiring and basic configuration of computer networks and devices, using software tools. |
| Mixed objective/subjective test | At the end of the term there will be an exam on the contents of the course.                                                                 |

| Personalized attention                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Methodologies                                            | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Laboratory practice<br>ICT practicals<br>Problem solving | <p>Lecture session: Attending and solving student's doubts related to the theoretical material presented in the lecture sessions.</p> <p>Problem solving: Attending and solving the student's doubts related to the problems presented in class.</p> <p>Laboratory practices: Attending and solving student's doubts related to the practices proposed or carried out in the laboratory.</p> <p>Practices through ICT: Attending and solving student's doubts related to the practices proposed or carried out through ICT.</p> <p>Personalized attention: In relation to the theory and problem solving classes, individualized tutoring hours will be preferably used. Tutorials may be face-to-face or telematic (via Teams).</p> <p>In relation to the practical classes, individualized tutoring hours will be preferably used, being also possible the use of e-mail. Tutorials may be face-to-face or telematic (via Teams).</p> |

| Assessment                      |                                                                                                |                                                                                                                                                                                                                                                   |               |
|---------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Methodologies                   | Competencies                                                                                   | Description                                                                                                                                                                                                                                       | Qualification |
| Laboratory practice             | A1 A2 A3 A11 A16<br>A18 A67 A68 A70 B2<br>B4 B5 B6 B7 B9 B11<br>C2 C7 C8 C9 C10<br>C11 C12 C13 | The work done by the student in each of the sessions will be evaluated.<br>Students with part-time dedication or with academic waiver from teaching exemption will have the option of taking a laboratory practice test at the end of the course. | 10            |
| Mixed objective/subjective test | A3 A18 A19 A59 A64<br>B1 B2 B4 B6 B7 B11<br>C2 C3 C7 C8 C9 C10<br>C11 C12 C13                  | It will consist of two theoretical exams and problem solving on the contents exposed throughout the course during the lectures sessions, evaluating the understanding of such contents, and its application to problem solving.                   | 60            |
| ICT practicals                  | A18 A67 B1 B2 B4 B5<br>B6 B7 B9 B11 C2 C3<br>C7 C8 C9 C10 C11<br>C12 C13                       | The work done by the student in each of the sessions will be evaluated.<br>Students with part-time dedication or with academic waiver from teaching exemption will have the option of taking an ICT practice test at the end of the course.       | 10            |
| Problem solving                 | A18 B2 B4 B5 B7 B9<br>B11 C2 C3 C7 C8 C9<br>C10 C11 C13                                        | It will consist of problem-solving assessment through a set of tests.                                                                                                                                                                             | 20            |

| Assessment comments |
|---------------------|
|---------------------|



The mixed test and the problem-solving tests constitute 80% of the grade. The evaluation of laboratory practices and through ICT constitute the remaining 20%.

Description of the evaluation and distribution of points.

## FIRST OPPORTUNITY

### A) MIXED TEST:

It will consist of two midterm exams of 6 points (maximum) each. In order to pass the subject, a minimum of 3 points must be obtained in each one. Once obtained, the grade of the mixed exam will be the average of the grades of both midterm exams.

If any of the midterm exams are not passed, the student will have the opportunity to pass them in the final exam (1st opportunity).

### B) PROBLEM SOLVING:

It will consist of a set of tests with a maximum combined evaluation of 2 points, with a minimum of 1 to pass the course.

In case of not passing the tests, the student will have a problem solving exam on the same date and time as the final exam (see item A).

This exam must be passed in order to pass the course.

### C) LABORATORY/TIC PRACTICES:

It will consist of a set of laboratory and computer simulation tasks (ICT) with a maximum joint evaluation of 2 points, with a minimum of 1 to pass the course. At the beginning of each practice, the student must pass a previous test. If the student fails the test, the grade of the corresponding practice will be halved.

In case of not passing the assignments, the student will have a laboratory exam on the same date and time as the final exam (see item A). This exam must be passed in order to pass the course.

### FINAL GRADE: if the three parts

(A, B and C) are passed, the final grade will be the sum of them. In case of failing, such a sum will be halved.

### Additional work (optional): the

student who has passed the course will have the option of voluntarily submitting a written work whose content and length (no more than 20 DIN A4 pages, single spaced, New Roman font size 10 or similar, with margins of 2 cm on each side of the page) will be determined by the theory professor. The score for this work (1 point maximum) will be added to the FINAL grade indicated above (to be reduced if the maximum of 10 points is exceeded).

### Detection of plagiarism or copying of work: the

fraudulent performance of the tests or evaluation activities will directly imply the qualification of failure '0' in the corresponding opportunity of the subject, thus invalidating any qualification obtained in all the evaluation activities for the second and advanced calls.

## SECOND OPPORTUNITY

For

the second opportunity the student may take a mixed test similar in



content and difficulty to that of the first opportunity, and must pass both parts. The grade obtained in the mixed test will be added to the laboratory practices, ICT and problem solving grades obtained in the first opportunity. In case of not passing the problem solving or the practicals, the student will have the corresponding exams, within the timetable corresponding to the mixed test. For the calculation of the total grade, the same criteria will be followed as for the first opportunity.

Students enrolled part-time or who have been granted academic dispensation of exemption from attendance, as established by the Rule that regulates the regime of dedication to the study of undergraduate students at UDC (Arts. 2.3; 3.b; 4.3 and 7.5) (04/05/2017), will take the same evaluation tests as students enrolled full-time. He/she will have the option of taking a lab/ICT practicum exam at each opportunity.

The evaluation criteria contemplated in Table A-II/1 of the STCW Code, and collected in the Quality Assurance System, will be taken into account when designing and carrying out the evaluation.



## Sources of information

|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Basic</b>         | <ul style="list-style-type: none"><li>- Mackay S., Wright E., Reynders D (2004). Practical industrial data networks: design, installation and troubleshooting. Elsevier</li><li>- Reynders D., Mackay S., Wright E. (2005). Practical industrial data communications: best practice techniques,. Elsevier</li><li>- Reynders D., Wright E. (2003). Practical TCP/IP and Ethernet networking,. Elsevier</li><li>- Strauss C. (2003). Practical electrical network automation and communication systems. Elsevier</li><li>- Thompson L. M. (2008). Industrial data communications. ISA</li><li>- Lees G. D. (2014). Handbook for Marine Radio Communication. Routledge</li><li>- Kurose J. F., Ross W. K. (2021). Computer Networking. A Top-Down Approach. Pearson</li></ul> <p>A fonte de información principal estará constituída polos apuntamentos da materia, achegados polo profesorado.</p> |
| <b>Complementary</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## Recommendations

### Subjects that it is recommended to have taken before

Informatics/631G02154

### Subjects that are recommended to be taken simultaneously

Electronic Systems for Vessels/631G02356

Digital Electronics/631G02364

Power and Analogue Electronics/631G02363

### Subjects that continue the syllabus

Electronic Systems for Vessels/631G02356

Electronic Systems for Data Acquisition/631G02562

### Other comments

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.