

Goi Eskola Politeknikoa Escuela Politécnica Superior

|   | [G   | JN103] INDUST   |   |  |  |  |   |
|---|--|---|---|--|--|--|---|
|   |  | GENE  | RAL IN  | FORMATION  |  |  |   |
| Studies   | DEGREE IN ME   | CHATRONICS ENGINE   | RING  | Subject  | ?  |  |   |
| Semester  | 2  | Course 3  |   | Mention / Field of   |  |  |   |
| Character   | COMPULSORY   |   |   | specialisation   |  |  |   |
| Plan  | 2020   | Modality Adap<br>Face   | ted<br>-to-face   | Language   | CASTELLANO   |  |   |
| Credits   | 4,5  | Hours/week 3.75   |   | Total hours  | 67.5 class hours<br>hours  | s + 45 non-cla   | ss hours = <u>112.5 -</u>   |
|   |  |   | PROFE   | SSORS  |  |  |   |
|   | A ALEGRIA, JUA   | AN LUIS   |   |  |  |  |   |
|   | LPURU, ENERITZ   | REQUIRED  | PREVIO  |  | GE   |  |   |
|   | Subie  | ects  |   |  | Knowl  | edae   |   |
| (No   | specific previous  | s subjects required)  |   | (1   | lo previous knov   | vledge require   | d)  |
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| RIFICA SKILL  | S  |   |   |  |  |  |   |
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| CE11 - Applied  | knowledge of ma  | intenance systems and o   | quality cont  | irol.  |  |  |   |
|   | ing and antimisis  | a potivition of apparety.   | oommiasia   | ning oppictures  | maintananas  | f fooilitico me  | hinony and  |
| ustrial mechatr   | and optimisin<br>onic systems  | ig activities of assembly,  | commissio   | ming, assistance and   | maintenance of   | i lacilities, mac  | minery, and   |
| CG04 - Manadi   | ng technically tea   | ms and people in activiti   | es of asser   | nbly, commissioning  | assistance and   | maintenance  | of facilities   |
| chinery and inc   | dustrial systems,  | through the methodology   | of adminis  | stration by projects for   | r the effective ex   | xecution of pla  | nning   |
| CC05 - Develor  | oing and designin  | g products, equipment a   | nd mechati  | ronic systems while o  | omplying with th   | ne technical, eo   | conomic, quality  |
| COO3 - Develop  | mente establisha   | d in the specifications ar  | d roguirod  | the state of the set o | n  |  |   |
| d safety require  |  | a in the specifications at  | la requirea   | by current legislation   | •  |  |   |
| RG301 They as portingencies a   | ssume responsi<br>nd encouraging   | bilities in the team, org   | ARNING<br>anizing an<br>members.  | RESULTS  | s to be develop  | bed, dealing w   | ⁄ith  |
| RG301 They as   | ssume responsi<br>nd encouraging   | bilities in the team, org<br>the participation of its   | ARNING<br>anizing an<br>members.  | RESULTS  | s to be develop  | oed, dealing w   | rith  |
| RG301 They as<br>ontingencies a   | ssume responsi<br>nd encouraging   | bilities in the team, org   | ARNING<br>anizing an<br>members.  | RESULTS  | s to be develop<br><i>CH</i>   | ped, dealing w   | /ith<br>TH  |
| RG301 They as<br>ontingencies a<br>LEARNING AC<br>Carrying out/res<br>interdisciplinary   | ssume responsil<br>nd encouraging<br>TIVITIES<br>solving projects/cf<br>contexts, real an  | bilities in the team, org<br>the participation of its<br>nallenges/cases, etc. to p<br>d/or simulated, individua  | ARNING<br>anizing an<br>members.  | A planning the task  | s to be develop<br><u>CH</u><br>2 h.   | Ded, dealing w<br>NCH<br>1 h.  | <b>/ith</b><br><u>TH</u><br>3 h.                                  |
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| Constant of the second se | ssume responsil<br>nd encouraging<br>TIVITIES<br>solving projects/cf<br>contexts, real an<br>SYSTEM<br>it<br>chnical capacity, .<br>s: 2 h.<br>s hours: 1 h.<br>: 3 h.   | bilities in the team, org<br>the participation of its<br>nallenges/cases, etc. to p<br>d/or simulated, individua  | ARNING<br>anizing an<br>members.  | Ad planning the task<br>utions to problems in<br>a teams<br><u>MAKE-UP MECH</u><br>Comments: Conti   | s to be develop<br><u>CH</u><br>2 h.<br>ANISMS<br>(No mech<br>nuous assessme   | oed, dealing w<br><u>NCH</u><br>1 h.<br>eanisms)<br>ent. Retake is i   | rith<br><u>TH</u><br>3 h.   |
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| Courrying out/res<br><b>EARNING AC</b><br>Carrying out/res<br>nterdisciplinary<br><b>EVALUATION</b><br>Self-assessment<br>Observation (ter<br>H - Class hours<br>CH - Non-class<br>H - Total hours  | ssume responsil<br>nd encouraging<br>TIVITIES<br>solving projects/cf<br>contexts, real an<br>SYSTEM<br>nt<br>chnical capacity, s<br>s: 2 h.<br>s hours: 1 h.<br>: 3 h.   | bilities in the team, org<br>the participation of its<br>nallenges/cases, etc. to p<br>d/or simulated, individua  | ARNING<br>anizing an<br>members.<br>provide solu<br>lly and/or in<br><u>w</u><br>30%<br>35%<br>) 35%  | A planning the task<br>utions to problems in<br>teams<br>MAKE-UP MECH<br>Comments: Conti   | s to be develop<br><u>CH</u><br>2 h.<br>ANISMS<br>(No mech<br>nuous assessme   | oed, dealing w<br><u>NCH</u><br>1 h.<br>eanisms)<br>ent. Retake is i   | rith TH 3 h. not foreseen.  |
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| RG301       They as         RG301       They as         Image: Solution of the second seco   | ssume responsil<br>nd encouraging<br>TIVITIES<br>solving projects/cf<br>contexts, real an<br>SYSTEM<br>it<br>chnical capacity,<br>s: 2 h.<br>s hours: 1 h.<br>: 3 h.<br>nalyze the variat<br>TIVITIES<br>solving projects/cf<br>contexts, real an<br>SYSTEM<br>chnical capacity,   | bilities in the team, org         bilities in the team, org         the participation of its         nallenges/cases, etc. to p         d/or simulated, individua         attitude and participation         bles involved in the pro         nallenges/cases, etc. to p         d/or simulated, individua  | ARNING<br>anizing an<br>members.<br>orovide solution<br>ily and/or in<br><i>W</i><br>35%<br>) 35%<br>blem and<br>provide solution<br>blem and<br>provide solution<br><i>W</i><br>) 100% | Ad planning the task<br>ad planning the task<br>utions to problems in<br>h teams<br>MAKE-UP MECH<br>Comments: Conti<br>propose actions for<br>utions to problems in<br>h teams<br>MAKE-UP MECH<br>Comments: Conti  | s to be develop<br><u>CH</u><br>2 h.<br>ANISMS<br>(No mech<br>nuous assessme<br>• a stable situat<br><u>CH</u><br>2 h.<br>ANISMS<br>(No mech<br>nuous assessme | ion.<br>NCH<br>1 h.<br>anisms)<br>ent. Retake is i<br>NCH<br>1 h.<br>vanisms)<br>ent. Retake is i  | rith TH 3 h. TH               |

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CH - Class hours: 2 h. NCH - Non-class hours: 1 h. TH - Total hours: 3 h.

RG304 They define the problem, the development of the solution, as well as the conclusions in an effective way, arguing and justifying each of them, making a correct use of the language, in writing. **NCH LEARNING ACTIVITIES** СН ΤН 2 h. 3 h. Development and writing of records, reports, presentations, audiovisual material, etc. on 1 h. projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams **EVALUATION SYSTEM** w MAKE-UP MECHANISMS 100% Reports on the completion of exercises, case studies, Reports on the completion of exercises, case studies, computer computer exercises, simulation exercises, laboratory exercises, simulation exercises, laboratory exercises, term exercises, term projects, challenges and problems projects, challenges and problems Comments: Revision and correction of the written report of the semester project CH - Class hours: 2 h. NCH - Non-class hours: 1 h. TH - Total hours: 3 h.

**RCEADS** They define the problem, the development of the solution, as well as the conclusions in an effective way, arguing and justifying each one of them, and making a correct use of the language, orally.

| Development and writing of records, reports, presentation projects/work experience/challenges/case studies/experi   | 2 h. | 1 h.               | 3 h.                    |                             |              |
|---|------|--------------------|-------------------------|-----------------------------|--------------|
| individually and/or in teams  |      | -                  |                         |                             |              |
| EVALUATION SYSTEM   | W    | MAKE-UP MECHAN     | SMS                     |                             |              |
| Presentation and defence of exercises, case studies,<br>computer practical work, simulation practical work,<br>laboratory practical work, term projects, end of degree<br>project, master's thesis, challenges and problems | 100% | Comments: Continuc | (No mech<br>ous assessm | anisms)<br>ent. Retake is i | not foreseen |
| CH - Class hours: 2 h.<br>ICH - Non-class hours: 1 h.<br>TH - Total hours: 3 h.   |      |                    |                         |                             |              |

| RGJ309 They identify and apply different tools and strategies to ensure Quality and Zero  | Defects i | in production | processes. |
|---|-----------|---------------|------------|
| LEARNING ACTIVITIES   | СН        | NCH           | тн         |
| Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams | 4 h.      | 1 h.          | 5 h.       |
| Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning  |           | 3 h.          | 3 h.       |
| Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints   | 1 h.      | 3 h.          | 4 h.       |
| Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in<br>interdisciplinary contexts, real and/or simulated, individually and/or in teams                                   | 6 h.      | 2 h.          | 8 h.       |
| Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects   | 6 h.      |               | 6 h.       |

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| Comments: Evidence: PC1 | Case study: Ze | ero defects. Reso | olution and | report writing |
|-------------------------|----------------|-------------------|-------------|----------------|

| EVALUATION SYSTEM   | W      | MAKE-UP MECHANISMS   |
|---|--------|--|
| Reports on the completion of exercises, case studies,<br>computer exercises, simulation exercises, laboratory<br>exercises, term projects, challenges and problems  | 50%    | Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems   |
| Presentation and defence of exercises, case studies,<br>computer practical work, simulation practical work,<br>laboratory practical work, term projects, end of degree<br>project, master's thesis, challenges and problems | 20%    | Individual written and/or oral tests or individual<br>coding/programming tests<br><b>Comments:</b> In the case of having to take the make-up test, final<br>mark: 75% of the make-up test + 25% of the first test. In case the |
| Individual written and/or oral tests or individual coding/programming tests   | 30%    | reports should be made up, they may be corrected.  |
| <b>Comments:</b> 30% PC1:Test_Introduction to Quality Manag<br>50% EN1:Strategies to achieve zero defects 20% POPBL   | jement |  |
| CH - Class hours: 17 h.   |        |  |

T

NCH - Non-class hours: 9 h. TH - Total hours: 26 h.

| RGJ310 They identify and apply different techniques used for planning and quality impro   | ovement.                        |  |                                      |
|---|---------------------------------|--|--------------------------------------|
| LEARNING ACTIVITIES   | СН                              | NCH  | тн                                   |
| Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams | 1,5 h.                          | 3 h.                                       | 4,5 h.                               |
| Personal study and flexible development of concepts and subjects using active dynamics, to<br>foster more meaningful learning   |                                 | 2 h.                                       | 2 h.                                 |
| Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints   | 2 h.                            | 1 h.                                       | 3 h.                                 |
| Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in<br>interdisciplinary contexts, real and/or simulated, individually and/or in teams                                   | 5 h.                            | 1 h.                                       | 6 h.                                 |
| Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects   | 4 h.                            |  | 4 h.                                 |
| Carrying out exercises and solving problems individually and/or in teams<br><b>Comments:</b> Case study: Zero defects. Case resolution and memory development Exercises: Pro-<br>1                              | <sub>3 h.</sub><br>areto, IShil | <sup>1 h.</sup><br>kawa, FMEA <sup>-</sup> | <sup>4 h.</sup><br>Tests: Checkpoint |
|   | 19                              |  |                                      |

| 30% | Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems                             |
|-----|--|
| 30% | Individual written and/or oral tests or individual coding/programming tests<br><b>Comments:</b> Recovery: 75% recovery + 25% initial test Reports:<br>Maximum score in the recovery "5". |
| 40% |  |
|     | 30%<br>30%<br>40%  |

CH - Class hours: 15,5 h. NCH - Non-class hours: 8 h. TH - Total hours: 23,5 h.

**RGJ311** They set up data collection systems and analyse the data collected in order to continuously improve the availability of the productive means.

| LEARNING ACTIVITIES   | СН | NCH  | ТН   |
|---|----|------|------|
| Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams | -  | 3 h. | 3 h. |



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| Personal study and flexible development of concepts and foster more meaningful learning   | using active dynamics, to     |   | 3 h.                          | 3 h.          |              |
|---|-------------------------------|---|-------------------------------|---------------|--------------|
| Conducting tests, giving presentations, presenting defenc<br>checkpoints  | es, taking                    | examinations and/or doing   | 2 h.                          | 2 h.          | 4 h.         |
| Carrying out/resolving projects/challenges/cases, etc. to p<br>interdisciplinary contexts, real and/or simulated, individual  | utions to problems in n teams | 2 h.  | 3 h.                          | 5 h.          |              |
| Presentation by the teacher in the classroom, in participat<br>procedures associated with the subjects  | ory classe                    | es, of concepts and   | 4 h.                          |               | 4 h.         |
| Carrying out exercises and solving problems individually a  | and/or in te                  | eams  | 4 h.                          | 3 h.          | 7 h.         |
| EVALUATION SYSTEM   | W                             | MAKE-UP MECHANISM   | IS                            |               |              |
| Reports on the completion of exercises, case studies,<br>computer exercises, simulation exercises, laboratory<br>exercises, term projects, challenges and problems  | 20%                           | Individual written and/or coding/programming tes<br>Comments: Recovery: 7 | oral tests<br>ts<br>75% Recov | or individual | ontrol point |
| Presentation and defence of exercises, case studies,<br>computer practical work, simulation practical work,<br>laboratory practical work, term projects, end of degree<br>project, master's thesis, challenges and problems | 30%                           |   |                               |               | ·            |
| Individual written and/or oral tests or individual coding/programming tests<br>Comments: PC2 50% EN2 20% POPBL 30%  |                               |   |                               |               |              |
| CH - Class hours: 12 h.<br>NCH - Non-class hours: 14 h.<br>TH - Total hours: 26 h.  |                               |   |                               |               |              |

| EARNING ACTIVITIES   |                              |   | СН                           | NCH           | ТН          |
|--|------------------------------|---|------------------------------|---------------|-------------|
| Development and writing of records, reports, presentation<br>projects/work experience/challenges/case studies/experi<br>individually and/or in teams   | 2 h.                         | 2 h.  | 4 h.                         |               |             |
| Personal study and flexible development of concepts and other more meaningful learning   | d subjects (                 | using active dynamics, to                           |                              | 3 h.          | 3 h.        |
| Conducting tests, giving presentations, presenting defen-<br>checkpoints   | ces, taking                  | examinations and/or doing                           | 1 h.                         | 3 h.          | 4 h.        |
| Carrying out/resolving projects/challenges/cases, etc. to<br>nterdisciplinary contexts, real and/or simulated, individua   | provide so<br>ally and/or    | lutions to problems in<br>in teams                  | 5 h.                         |               | 5 h.        |
| Presentation by the teacher in the classroom, in participa<br>procedures associated with the subjects  | es, of concepts and          | 4 h.  |                              | 4 h.          |             |
| Carrying out exercises and solving problems individually<br>Comments: Exercises: EFFICIENCIES, INDICATORS R  | and/or in te<br>Reports: kai | eams<br>izen tools work Tests: check                | 3 h.<br>point                | 2 h.          | 5 h.        |
| EVALUATION SYSTEM  | W                            | MAKE-UP MECHANISM                                   | IS                           |               |             |
| Reports on the completion of exercises, case studies,<br>computer exercises, simulation exercises, laboratory<br>exercises, term projects, challenges and problems   | 10%                          | Individual written and/or<br>coding/programming tes | oral tests<br>ts<br>75% Reco | or individual | ntrol point |
| Presentation and defence of exercises, case studies,<br>computer practical work, simulation practical work,<br>aboratory practical work, term projects, end of degree<br>project, master's thesis, challenges and problems | 40%                          |   | 07011000                     | very 1 20% ee |             |
|  | 50%                          |   |                              |               |             |

## CONTENTS

### **Quality engineering**



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1.Introduction to quality Management

- 2. Quality Control
- 1. Quality Control: Zero defects
- 2.Self-inspection
- 3.Basic statistics
- 4. Statistical Process Control (S.P.C.)
- 5.Inspection at the source. Poka-Yoke
- 3. Quality Planning/ Prevention
- 1. Quality planning
- 2.Failure mode and efects analysis (FMEA)

#### Maintenance Management

- 1. Introduction to Maintenance Management
- 2. Types of Maintenance
- 1.Corrective, Preventive, Predictive
- 3. Indicators in Maintenance Management
- 1. Maintainability, Reliability and Availability
- 2.Efficiency\_ 6 major losses
- 3.Other indicators
- 4.Implementation of a Maintenance Management system
- 1.Prerequisites
- 2.RCM\_AMFE
- 3.TPM and Autonomous Maintenance
- 5.CMMS\_Computerised Maintenance Management

## LEARNING RESOURCES AND BIBLIOGRAPHY

| Learning resources                  | Bibliography  |  |  |  |  |
|-------------------------------------|---|--|--|--|--|
| Subject notes                       | Procesos y Gestión de Mantenimiento y Calidad. Raimundo   |  |  |  |  |
| Moodle Platform                     | Fernández Díez. Marcombo 2018   |  |  |  |  |
| Class presentations                 | http://katalogoa.mondragon.edu/janium-bin/janium_login_opac_re_ln   |  |  |  |  |
| Presentations by external Lecturers | K.pl/grupo=MECATRONICA32&ejecuta=20&_51   |  |  |  |  |
|                                     | OZEKI, K. ASAKA, T. Handbook of Quality Tools. The Japanese approach. Productivity Press.                   |  |  |  |  |
|                                     | Advanced Quality Product Planning (APQP) and Control Plan<br>including PPAP 2000. Plexus Corporation, 1999. |  |  |  |  |
|                                     | Product- Process FMEA. Renault Institute of Quality Management.   |  |  |  |  |
|                                     | Moubray John, RCM II Mantenimiento Centrado en Confiabilidad,<br>Aladon LLC, 2004                           |  |  |  |  |



Introducción al TPM. Seiichi Nakajima. 1991. Tecnologías de Gerencia y Producción. TPM en Industrias de Proceso. Tokutaro Suzuki. 1996. Productivity Press