**NANOTECHNOLOGY FOR SUSTAINABLE AGRICULTURE**

The course is held on Wednesdays from 9:00 to 11:30 a.m. and begins on August 31 and ends on November 23.

**DESCRIPTION**

*Nanotechnology and nanoscience are the study of very small particles and structures (between 100-1 nm). In this size range, materials exhibit distinct properties that are not found in the same materials in the macroscale. These properties permit applications in diverse areas like electronics, medicine and materials science.*

*The course will integrate knowledge of chemistry, physics with the applications of nanotechnology and nanoscience in order to visualize its use in the agricultural and environmental sectors. To be studied are the different classes of nanomaterials investigated in nanoscience, their properties and creation.. It will give special emphasis in the application of these materials in agriculture and food production.*

**LEARNING OUTCOMES**

* *Understand and analyze the physics and chemistry of nanomaterials, their specific applications with respect to the agricultural and food sectors, the potential of future applications on these systems, and the visualization of the impact of the use of nanomaterials on the environment*.
* *Understand the possibilities and challenges of the use of nanomaterials and other forms of nanotechnology in the formation of a sustainable agri-food sector with low environmental impact.*
* *Analyze the literature and other sources critically.*

**METHODOLOGY**

Virtual lectures, Self-study, Presentations Group Research, PBL

**RESOURCES**

Audiovisual resources like ppt presentations and class recordings on the UCursos Platform

**CONTENIDOS**

(*Corresponde a los saberes / contenidos pertinentes y suficientes para el logro de los Resultados de Aprendizaje de la Asignatura)*

| Chapter | Contents |
| --- | --- |
| 1. What are nanomaterials?
 | A general visión of nanomaterials |
| The general physics of nanomaterials, why do they behave so strangely?  |
| 1. Types of nanomaterials
 | A description of various classes of nanomaterials, synthesis methods and potential applications. |
| Types of nanomaterials included are metal particles (gold, silver, copper etc), quantum dots, magnetic nanomaterials, clays, carbon nanomaterials (fullerenes, carbon nanotubes, graphene etc), and polymers. |
| 1. Nanomaterials in Agriculture.
 | Nanosensors: The use of nanosensors to monitor field conditions. |
| Nanofertilizers: The use of nanomaterials to deliver nutrients or otherwise promote crop growth.  |
| Nanopesticides: The use of nanomaterials to deliver pesticides or reduce the activity of pests and other factors that can reduce yield.  |
| 1. Nanomaterials in the food industrys
 | The use of nanomaterials in food packaging to protect and monitor food.  |
| The use of nanomaterials to create better food and maintain its quality. |
| 1. Nanomaterials in the environment.
 | The use of nanomaterials in the remediation of the environment.  |
| Nanomaterials as pollutants. Methods to prevent their loss to the environment.  |
| 1. Nanotoxicology
 | The effects of nanoparticles on human health. How to reduce the risk. |

| **Week** | **Date** | **Type** | **TOPIC** | **PROFESOR** |
| --- | --- | --- | --- | --- |
| **1** | **31/08/2022** | Class | Introduction, what is nanotechnology | Joseph Govan |
| **2** | **07/09/2022** | Class  | Types of Nanomaterials 1  | Joseph Govan |
| **3** | **15/09/2022** | Class  | Types of Nanomaterials 2 | Joseph Govan |
| **4** | **22/09/2022** | Break | Break Patriotic Festival | N/A |
| **5** | **29/09/2022** | Class | Nanotechnology in agricultura 1 | Joseph Govan |
| **6** | **05/10/2022** | Class | Nanotechnology in agricultura 2 | Joseph Govan |
| **7** | **12/10/2022** | Test | Multiple Choice test 1 | Joseph Govan |
| **8** | **19/10/2022** | Class | Nanotechnology in food 1 | Joseph Govan |
| **9** | **26/10/2022** | Class | Nanotechnology in food 2 | Joseph Govan |
| **10** | **02/11/2022** | Class | Nanotechnology and the environment 1 | Joseph Govan |
| **11** | **09/11/2022** | Class | Nanotechnology and the environment 2 | Joseph Govan |
| **12** | **16/11/2022** | Class | Nanotoxicology | Joseph Govan |
| **13** | **23/11/2022** | Test | Multiple choice test 2 | Joseph Govan |

**EVALUATION**

| *INSTRUMENT* | *Porcentage* |
| --- | --- |
| Test 1 (Multiple choice) | 20% |
| Test 2 (Multiple choice) | 20% |
| Essay (A report on the theme of nanotechnology in the agri-food sector or the environment.) | 30% |
| Short video (A recording of at least 5 minutes of a topic related to the material) | 30% |
| Nota presentación a examen | 75% |
| Examen | 25% |

1. Booker R., Boysen E, 2005, Nanotechnology for dummies, Wiley Publishing Inc. Hoboken United States. 384 p. ISBN: 978-0470891919
2. Husen A. Mohammad J. 2020. Nanomaterials for Agriculture and Forestry applications. Elsevier-Academic Press. London. United Kingdom. 562 p. ISBN: 978-0128178522
3. Oprea A. E., Grumezescu A. M. 2017. Nanotechnology Applications in Food Flavor, Stability, Nutrition and Safety, Elsevier-academic press. London. United Kingdom. 416 p. ISBN: 978-0128119426

**BIBLIOGRAFÍA COMPLEMENTARIA**

1. Ranjan S. Dasgupta N. Lichtfouse E. 2017. Nanoscience in Food and Agriculture 4, Sustainable Agriculture Reviews book series (SARV volume 24). Springer Nature. Switzerland. 305 p. ISBN: 978-3319850658
2. Ramsden J.J., 2018, Applied Nanotechnology: The Conversion of Research Results to Products: A volume in Micro and Nano Technologies, Science Direct, 292 p. ISBN: 978-0128133439

**RECURSOS WEB**

1. Biblioteca digital de la universidad de Chile. Base de datos: <https://www.uchile.cl/portal/informacion-y-bibliotecas/servicios-de-biblioteca/bases-de-datos/57681/indice-por-titulo>
2. Biblioteca de la universidad de chile. Libros electrónicos: <https://www.uchile.cl/portal/informacion-y-bibliotecas/servicios-de-biblioteca/75613/libros-electronicos>
3. U Cursos <https://www.u-cursos.cl/>

**Explanatory Notes:**

**Credits (SCT):** 1 credit corresponds to 25 hours of total student work

**Grading System:**

**a)**

| **Points** | **Standard** |
| --- | --- |
| 7.0 | Superior Achievement |
| 6.0 – 6.9 | Very Good |
| 5.0 – 5.9 | Good |
| 4.0 – 4.9 | Fair – Passing Grade |
| 1.0 – 3.9 | Fail |