Universidad de Puerto Rico
Recinto Universitario de Mayagüez
Departamento de Humanidades/Sección de Filosofía

Curso FILOSOFIA DE LA CIENCIA

Numeración FILO 3168

Semestre Spring Semester, 2018

Profesor Dr. Halley D. Sánchez
Oficina: F-433 (Edificio de Física)
Horario de Oficina: Martes/Jueves 7:00-9:00; 4:45-5:45
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Texto Principal

Sanchez, Halley D. (2003/2007), *Physics as Philosophy*. Mayagüez, PR: Universidad de Puerto Rico, Recinto Universitario de Mayagüez. (disponible en la Libreria Colegial)

Material Adicional (incluyendo prontuario completo) – MOODLE/ECOURSES-UPRM

Otras lecturas (vea la página 3 de este prontuario para recomendaciones adicionales)

Calificación

La calificación final se determinará en base a:

- Dos exámenes parciales de 100 puntos cada uno (se someterán **dos copias** de cada examen parcial: una en hard copy y otra digital a través de Turitin)
- Una presentación oral de grupo y examen final con un valor máximo de 100 puntos (junto con la presentación se entregará un bosquejo escrito de la misma que luego se corregirá y servirá como examen final)
    - El examen final consiste de la versión escrita y corregida de la presentación oral
- Una calificación asignada por el profesor para la participación (máximo de 100 puntos)
    - Para esta última, en adición a la participación en las discusiones en clase, se tomará en cuenta ausencias y tardanzas. También se tomará en cuenta la asistencia (requerida) a las hasta dos películas que han de verse en secciones especiales (de reposición) por las noches.

La calificación final dependerá del total de putos recibidos de los posibles 400 puntos. La cantidad de puntos para cada calificación será determinada por el profesor al final del semestre, pero en ningún caso sería mayor de la llamada curva estándar (90, 80, 70, 60 puntos respectivamente). Ausencias excesivas (más de 3) pudieran resultar en la disminución de la calificación final.

La deshonestidad académica, como, por ejemplo, copiarse en exámenes o cometer plagio, pudiera resultar en la calificación de reprobado ("F") para el curso entero.

This course will be using Turnitin. This is an online web tool that compares a student's work with millions of published works available through the Internet and library databases and generates an originality report. All required assignments in this course, including exams, may be checked for plagiarism using Turnitin.

Temas

I. The Beginning of Science and Philosophy: basic notions of natural philosophy, particularly in ancient times

- Philosophy and science vs. the mythical tradition
- The mathematical approach of Pythagoras and Plato
  - -Science/philosophy as the goal of life
- Aristotelian physics
- Ancient and Medieval Astronomy

II. Philosophical Foundations of the Seventeenth Century Scientific Revolution

- Astronomy in the Modern World: Copernicus, Kepler, and Galileo
- The mathematization of nature: time, space, and movement.

III. The Mechanical Philosophy, the Science of Mechanics, and the Newtonian Synthesis

- The mechanical philosophy
- Newton's development of the mathematical concepts of force and mass
- Newton's synthesis of:
  - -the approaches of Kepler and Galileo
  - -the mechanical tendency and mathematical mechanics

IV. The Concept of the Field

V. The Special Theory of Relativity

- The Michelson-Morley experiment
- The invariance of the laws of electrodynamics and optics
- Relativity of simultaneity and the Lorentz transformation equations
- The concept of spacetime
- The transmutation of energy and matter, and its implications

VI. The General Theory of Relativity

- Non-Euclidean geometry
- The Equivalency principle
- Gravitational force as the curvature of spacetime
- Empirical proofs and results
- Cosmological implications

VII. Quantum Mechanics and the Copenhagen Interpretation

- Max Planck and the ultraviolet catastrophe, Einstein and the photoelectric effect, Niels Bohr's early model of the atom
- Matrix mechanics and wave mechanics
- Heisenberg's indeterminacy (uncertainty) principle and Born's probabilistic interpretation
- Complementarity

VIII. The EPR Debate, Bell's Theorem, Recent Experiments

- The EPR argument and Bohr's response
- Bell's theorem and recent related experiments (such as the Aspect experiments)
- Philosophical conclusions about our concept of reality implied by recent Bell-type experiments

IX. The Present Situation and Projecting Towards the Future

- The standard model of particle physics
  - Methodological/philosophical problems with the standard model
- Alternative theories (such as string/M theory)
- Contemporary cosmological questions
  - Inflation Theory
  - Dark Matter and Dark Energy
- Science and the future
- Science and the idea of the sacred

Lecturas según Tema

I. The Beginning of Science and Philosophy: basic notions of natural philosophy, particularly in ancient times

Reading Assignment: Sanchez, *Physics as Philosophy*, Chapter 1.

II. Philosophical Foundations of the Seventeenth Century Scientific Revolution

Reading Assignment: Sanchez, *Physics as Philosophy*, Chapter 2.

III. The Mechanical Philosophy, the Science of Mechanics, and the Newtonian Synthesis

Reading Assignment: Sanchez, *Physics as Philosophy*, Chapter 4.

Optional Reading: Sanchez, *Physics as Philosophy*, Chapter 3.

IV. The Concept of the Field

Optional Reading: Sanchez, *Physics as Philosophy*, Chapter 5.

V. The Special Theory of Relativity

Reading Assignment: Sanchez, *Physics as Philosophy*, Chapter 6.

Optional Reading: Einstein, *Relativity: The Special and General Theory*, Part I.

VI. The General Theory of Relativity

Reading Assignments: Sanchez, *Physics as Philosophy*, Chapter 7.

Optional Reading: Einstein, *Relativity: The Special and General Theory*, Part II and III.

VII. Quantum Mechanics and the Copenhagen Interpretation

Reading Assignment: Sanchez, *Physics as Philosophy*, Chapter 8.

Optional Reading: Heisenberg, *Physics and Philosophy*, pp. 30-58.

VIII. The EPR Debate, Bell's Theorem, Recent Experiments

Reading Assignment: Sanchez, *Physics as Philosophy*, Chapter 9.

Optional Reading: Einstein, Podolsky, Rosen, "Can Quantum-Mechanical Description of Reality be Considered Complete?

Bohr, "Can Quantum-Mechanical Description of Reality be Considered Complete?"

Shimony, "Notes on Bell's Theorem."

Shimony, "The Reality of the Quantum World."

IX. The Present Situation and Projecting Towards the Future

Reading Assignment: Sanchez, *Physics as Philosophy*, Chapter 9, pp. 244-250.

During two special evening sessions, up to two movies may be viewed as a basis for discussion during regular class periods. Specific movies to me announced later.

Optional Reading: Greene, *The Elegant Universe*, pp. 117-387 (video also available)

Thorne, *Black Holes & Time Warps,"* pp. 23-58; 483-521

Guth, The Inflationary Universe and Tegmark, Our Mathematical Universe

http://science.nasa.gov/astrophysics/focus-areas/what-is-dark-energy/