



**Republic of the Philippines
OFFICE OF THE PRESIDENT
COMMISSION ON HIGHER EDUCATION**

SCIENCE, TECHNOLOGY, AND SOCIETY Preliminaries

Course Title : **Science, Technology, and Society**

No. of Units : **3 units**

Course Description:

The course deals with interactions between science and technology and social, cultural, political, and economic contexts that shape and are shaped by them. (CMO No. 20, series of 2013)

This interdisciplinary course engages students to confront the realities brought about by science and technology in society. Such realities pervade the personal, the public, and the global aspects of our living and are integral to human development. Scientific knowledge and technological development happen in the context of society with all its socio-political, cultural, economic, and philosophical underpinnings at play. This course seeks to instill reflective knowledge in the students that they are able to live the good life and display ethical decision making in the face of scientific and technological advancement.

This course includes mandatory topics on climate change and environmental awareness.

Learning Outcomes

At the end of the course, the students should be able to:

Knowledge

1. Articulate the impacts of science and technology on society, specifically Philippine society

2. Explain how science and technology affect society and the environment and its role in nation-building
3. Analyze the human condition in order to deeply reflect and express philosophical ramifications that are meaningful to the student as a part of society
4. Define and demonstrate the impact of social media on the students' life and Philippine society in general

Values

1. Imbibe the importance of science and technology in the preservation of the environment and the development of the Filipino nation
2. Critique human flourishing vis-à-vis the progress of science and technology such that the student may be able to define for himself/herself the meaning of the good life
3. Foster the value of a healthy lifestyle toward the holistic and sustainable development of society and the environment

Skills

1. Creatively present the importance and contributions of science and technology to society
2. Examine shared concerns that make up the good life in order to come up with innovative and creative solutions to contemporary issues guided by ethical standards
3. Illustrate how the social media and information age impact their lives and their understanding of climate change

Number of Hours: **3 hours every week for 18 weeks or 54 hours in a semester**

Course Outline and Timeframe

Week	Topics
	GENERAL CONCEPTSD AND STS HISTORICAL DEVELOPMENTS
1-3	Historical antecedents in which social considerations changed the course of science and technology
4	Intellectual revolutions that defined society
5-6	Science and technology and nation building
	STS AND THE HUMAN CONDITION
7-8	The Human Person flourishing in terms of science and technology

9	The Good Life
10	When technology and humanity cross
11-12	Why the future does not need us
	SPECIFIC ISSUES IN STS
13	The Information Age
14-15	Biodiversity and the healthy society
16	The nano world
17-18	Gene therapy, Culminating Activity

SCIENCE, TECHNOLOGY, AND SOCIETY Learning Plan

Learning Outcomes	Topic	Method	Resources	Assessment
GRADING PERIOD A. GENERAL CONCEPTS AND STS HISTORICAL DEVELOPMENTS				
<ul style="list-style-type: none"> • Discuss the interactions between S&T and society throughout history • Discuss how scientific and technological developments affect society and the environment • Identify the paradigm shifts in history 	<p>1. Historical antecedents in which social considerations changed the course of science and technology</p> <p>a. In the World: Ancient, Middle and Modern Ages</p> <p>b. In the Philippines</p>	<p>Lecture and discussion</p> <p>Activity: “Standing on the shoulders of Giants”</p>	<ul style="list-style-type: none"> • Philosophy of Science (Encyclopedia) Scientific Progress, Scientific Revolutions • Floridi, Luciano. 2014. The Fourth Revolution, Oxford University Press • Caoli. History of Science and Technology of the Philippines. • Video: Stephen Colbert’s interview with Neil Tyson https://www.youtube.com/watch?v=YXh9RQCvxmg&noredirect=1 • Youtube: World’s Greatest Inventions (3 minutes) • Philippine Great Inventions • Paul Anderson article: “More is Different” 1976 • https://explorable.com/scientific-reductionism • https://explorable.com/what-is-a-paradigm • http://www.history.com/topics/enlightenment/videos/mankind-the-story-of-all-of-us-scientific-revolution • Kuhn , Structure of Scientific Revolution 	<p>Quiz (40 points)</p> <p>Graded recitation (20 points)</p> <p>Group presentation (40 points)</p> <p>15 Creativity 15 Content 10 Learning Impact</p>

Learning Outcomes	Topic	Method	Resources	Assessment
<ul style="list-style-type: none"> • Articulate ways by which society is transformed by science and technology 	2. Intellectual revolutions that defined society <ol style="list-style-type: none"> a. Copernican b. Darwinian c. Freudian d. Information e. Meso-American f. Asian g. Middle East h. African 	Lecture and Discussion	<ul style="list-style-type: none"> • http://www.flowofhistory.com.readings • Flowcharts/revival-west/the-age-enlightenment • http://hti.osu.ed/scientific revolution/lesson plans • Powerpoint presentation on the individual scholars and great works. 	Quiz (50 points) Graded Activity (30 points) Graded recitation (20 points)
<ul style="list-style-type: none"> • Discuss the role of Science and Technology in Philippine nation building • Evaluate government policies pertaining to science and technology in terms of their contributions to nation building • Identify actual science and 	3. Science and Technology and Nation Building <ol style="list-style-type: none"> a. The Philippine Government S&T Agenda b. Major development programs and personalities in S&T in the Philippines c. Science 	Small Group Activity Discussion	<ul style="list-style-type: none"> • Government Documents: 1. NEDA. National Development Agenda; Regional Agenda • Filipino Great Men and Women • Great Filipino Inventions 	Group Project presentation

technology policies of the government and appraise their impact on the development of the Filipino nation	Education in the Philippines d. Selected indigenous science and technologies			
GRADING PERIOD B. STS AND THE HUMAN CONDITION				
Learning Outcomes	Topic	Method	Resources	Assessment
<ul style="list-style-type: none"> Analyze the human condition in order to deeply reflect and express philosophical ramifications that are meaningful to the student as a part of society 	<p>The Human Person flourishing in terms of science and technology</p> <p>Technology as a Way of Revealing</p>	Reflection, Discussion	<p>The Question Concerning Technology by Martin Heidegger</p> <p>A Return to the Beginning by Daniel J. McNamara, SJ, in Stellar Origins, Human Ways (2011)</p>	
<ul style="list-style-type: none"> Critique human flourishing vis-à-vis the progress of science and technology so that the student can define for himself/herself the meaning of 	Human flourishing	Discussion	<ul style="list-style-type: none"> Movie Clip (YouTube): The Magician's Twin: CS Lewis and the case against Scientism Film: Akira Kurosawa's Dreams "Village of the Watermills" Forget 'developing' rich countries, it's time to 'de-develop' rich countries. By Jason Hickel http://www.theguardian.com/global-development-professionals-network/2015/sep/23/developing-poor- 	Group Presentation on how technology reveals nature and the human person's role in it

the good life			countries-de-develop-rich-countries-sdgs Sustainable Development: An Evolving Paradigm for the 21 st Century by Fabian Dayrit in Stellar Origins, Human Ways (2011)	
Learning Outcomes	Topic	Method	Resources	Assessment
<ul style="list-style-type: none"> Examine shared concerns that make up the good life in order to come up with innovative, creative solutions to contemporary issues guided by ethical standards 	The Good Life	Lecture and Discussion	<ul style="list-style-type: none"> Book VI and Bk X Nichomachean ethics of Aristotle What Is and What should be the role of scientific culture in modern society – Richard Feynman in the Pleasure of Finding Things Out: The Best Short Works of Richard Feynman 1999 Perseus Books. USA pp97-115 The Concepts of the Public Good: A View from the Filipino Philosopher by Rolando Gripaldo in the Making of a Filipino Philosopher and Other Essays, 2009, National Bookstore pp 82-101 Eudaimonia and Human Flourishing in Ethics and Human Dignity by Christopher Ryan Maboloc). Manila, 2010. Rex Bookstore pp 15-23 That Sugar Film (2015) (documentary) Ppt: towards a green economy: pathways to sustainable development and poverty eradication–UNEP 	Case Study: Production and Consumption of sugars

Learning Outcomes	Topic	Method	Resources	Assessment
<ul style="list-style-type: none"> Examine human rights in order to uphold such rights in technological ethical dilemmas 	When technology and humanity cross	Reflection and Discussion	<ul style="list-style-type: none"> The ethical dilemmas of robotics http://news.bbc.co.uk/2/hi/technology/6432307.stm Is Google Making Us Stupid? 2008. Nicholas Carr http://www.theatlantic.com/magazine/archive/2008/07/Is_google_making_us_stupid/306868/ 	
<ul style="list-style-type: none"> Evaluate contemporary human experience in order to strengthen and enlighten the human person functioning in society 	Why does the future not need us?	Reflection and discussion	<ul style="list-style-type: none"> Why The Future Doesn't Need Us (2000) – Bill Joy, Chief Scientist and Corporate Executive Officer of Sun Microsystems http://www.cc.gatech.edu/computing/nano/documents Movie: "A I" Isaac Asimov, "I Robot" 	<ul style="list-style-type: none"> Case Study: WAZE
<p>Section Exam: Find and examine local government policies that protect the well-being of the person in the face of new technologies</p>		Group Work		<p>Group Presentation : Content and Relevance - 30% Analysis - 40% Creativity & teamwork - 30%</p> <p>----- 100%</p>

Grading Period C. SPECIFIC ISSUES IN STS

Learning Outcomes	Topic	Methodology	Resources	Assessment
<ul style="list-style-type: none"> • Link learned concepts to the development of the information age and its impact on society • Illustrate how the social media and the information age have impacted our lives 	<p>The information Age (Gutenberg to Social media)</p>	<p>Presentation and Discussion</p>	<ul style="list-style-type: none"> • Book: “Alan Turing: The Enigma” (Andrew Hodges and Douglas Hofstadter) • TEDTalk: Julian Assange on “Why the World Needs Wikileaks” • Activity Report: A day without Technology • Activity Report: Timing your Technology • Activity Report: Technology and Past (interviews with elders) • Nature’s Longest Threads by Janaki Balakrishnan and B V Sreekantan • How we decide by Jonah Lehrer • Information: The new language of science (Hans Christian von Baeyer) • Philippine Science and Technology: Economic, Political and Social Events Shaping Their Development (Socorro M. Rodriguez, 1996) • Germ Catcher (David J. Ecker, Scientific American, 2014) • Physics of the Future: How science will shape human destiny and our daily lives by the year 2100 (Michio Kaku, Doubleday, 2011) 	<p>Book Report</p> <p>Activity Report: A day without Technology</p> <p>Activity Report: Timing your Technology</p> <p>Activity Report: Technology and Past (interviews with elders)</p>

<ul style="list-style-type: none"> • Determine the interrelatedness of society, environment, and health • Discuss the ethics and implications of GMOs and potential future impacts 	<p>Biodiversity and the Healthy Society</p> <p>Genetically Modified Organisms: Science, Health, and Politics</p>	<p>Presentati on and Discussion</p>	<p>Life and Biodiversity ppt. Evolution and biodiversity Ecoscience-Biodiversity: an overview</p> <ul style="list-style-type: none"> • Article: “The politics of golden Rice” (Dubock, Adrian GM Crops & Food. Jul-Sep2014, Vol5 Issue 3 p 210-222 13p.) • Article: “Ethics in Research with Vulnerable Populations and Emerging Countries: The Golden Rice Case.” (Duguet, Anne Marie et. al., Journal of International Law and Commercial Regulations. Summer 2013, Vol. 38 Issue 4, p979-1013, 35p) Agroecology: What it is and what it has to offer? Is this the future of farming? 	<p>Graded recitation/ debate</p>
<ul style="list-style-type: none"> • Discuss the major impacts (both potential and realized) of nanotechnology on society • Analyze the issue through the conceptual STS lenses • Critique the issue on its costs and benefits to society 	<p>The Nano World</p>	<p>Presenta tion and Discus sion</p>	<ul style="list-style-type: none"> • TEDTalk: Ray Kurzwell on “How Technology Will Transform Us” • Article: “Nanoethics: The ethical and Social Implications of Nanotechnology” (Patrick Lin and Fritz Allhoff, Hoboken, New Jersey: John Wiley and Sons, Inc. 2007) • Article: “Environmental Impacts of Nanotechnology and Its Products” (Zhang et. Al Proceedings of the 2011 Midwest Section Conference of the American Society for Engineering Education, 2011) • Ppt: Can we build a culture of science through nanotechnology? By Fabian M. Dayrit (2013) 	

<ul style="list-style-type: none"> Describe gene therapy and its various forms Assess the issue's potential benefits and detriments to global health 	Gene therapy (stem Cells)	Presentation and Discussion	<ul style="list-style-type: none"> Youtube: Science Friction: Stem Cell Research TEDTalk: Susan Lim on "Transplant Cells Not Organs" TED Talk: Juan Enriquez on "the Next Species of Human" 	
<ul style="list-style-type: none"> Identify the causes of climate change Assess the various impacts of climate change including economic, geopolitical, biological, meteorological, etc. Apply STS concepts to the issue of climate change 	<p>Mandated Topics:</p> <p>1. Climate Change and the Energy Crisis</p> <p>2. Environmental Awareness</p> <p>Other Topics:</p> <p>Alternative Energy Resources (e.g. O-tech Ocean Thermal Energy Conversion)</p>	Presentation and Discussion	<ul style="list-style-type: none"> YouTube: or Book "An inconvenient Truth: The Planetary Emergency of Global Warming and What we can Do About It" (Al Gore) Book: "The Future: Six Drivers of Global Change" (Al Gore) Report: " Changing the Atmosphere: Anthropology and Climate Change" (NCAR) BUHOS: A Climate Change Documentary by Loren Legarda Article: " The Tragedy of the Commons" by Garrett Hardin Article: "Scientists tackle mystery of thunderstorms that strike at night" (NCAR) Article: "Reigning in the Weather" (Webster, Donovan, Discover, 02747529. Jun2008, Vol. 29, Issue 6) 	<ul style="list-style-type: none"> Group presentation and discussion <p>Learning application: weather control</p>
Research, present, and make a stand on S&T issues that currently affect	Culminating Activity and Final Exam	Presentation and group work		Final Exam Content and Relevance 30%

Philippine society				Analysis 40% Creativity & teamwork 30% <hr/> 100%
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SCIENCE, TECHNOLOGY, AND SOCIETY Course Map

G.E. Learning Outcomes	Science, Technology, and Society
A. INTELLECTUAL COMPETENCIES (Knowledge)	
1. Analyze “texts” (written, visual, oral , etc.) critically	L
2. Demonstrate proficient and effective communication (writing, speaking, and use of new technologies)	L
3. Use basic concepts across the domains of knowledge	L
4. Demonstrate critical, analytical, and creative thinking	L
5. Apply different analytical modes in problem solving	L
B. PERSONAL AND CIVIC RESPONSIBILITIES (Values)	
1. Appreciate the complexity of the human condition	
2. Interpret the human experience from various perspectives	O
3. Examine the contemporary world from both Philippine and global perspectives	O
4. Take responsibility for knowing and being Filipino	O
5. Reflect critically on shared concerns	O
6. Generate innovative practices and solutions guided by ethical standards	O
7. Make decisions based on moral norms and imperatives	O
8. Appreciate various art forms	
9. Contribute to aesthetics	O
10. Contribute personally and meaningfully to the country’s development	O

C. PRACTICAL SKILLS (Skills)	
1. Work effectively in a group	O
2. Apply computing tools to process information effectively	L
3. Use current technology to assist and facilitate learning and research	L
4. Negotiate the world of technology responsibly	P

5. Create solutions to problems in various fields	P
6. Manage one's knowledge, skills, and values for responsible and productive living	O
7. Organize one's self for lifelong learning	O

Legend:

L = Learned

P = Practiced

O = Opportunity to learn

SCIENCE, TECHNOLOGY, AND SOCIETY Required Readings and Other Materials

- Anderson, Philip W. "More is Different—One More Time," in *More is Different: Fifty Years of Condensed Matter Physics*, ed. N. Phuan Ong and Ravin N. Bhatt, Princeton University Press, 2001.
- Balakrishnan, Janaki and B V Sreekantan, eds. *Nature's Longest Threads: New Frontiers in the Mathematics and Physics of Information in Biology*, World Scientific, 2014.
- Caoli, Olivia. "A History of Science and Technology of the Philippines," in *Analysis of Conditions for National Scientific and Technological Self-Reliance: The Philippine Situation*, Quezon City: University of the Philippines, 1986.
- Dayrit, Fabian. "Sustainable Development: An Evolving Paradigm for the 21st Century," in *Stellar Origins, Human Ways: Readings in Science, Technology, and Society*, ed. Ma. Assunta Cuyegkeng, Quezon City: Ateneo de Manila University Press, 2011.
- Ecker, David J. Germ Catcher, *Scientific American*, 2014.
- Floridi, Luciano. *The Fourth Revolution: How the Infosphere is Reshaping Human Reality*, Oxford University Press, 2014.
- Feynman, Richard. "The Pleasure of Finding Things Out: What Is and What should be the role of scientific culture in modern society" in *The Best Short Works of Richard Feynman*, pp. 97–115, Perseus Books, 1999.
- Gripaldo, Rolando. "The Concepts of the Public Good: A View from the Filipino Philosopher" in *The Making of a Filipino Philosopher and Other Essays*, pp. 82-100, National Bookstore, 2009.
- Heidegger, Martin. *The Question Concerning Technology and Other Essays*, HarperCollins, 1982.
- Hickel, Jason. "Forget 'developing' poor countries, it's time to 'de-develop' rich countries," *The Guardian*, Online: <http://www.theguardian.com/global-development-professionals-network/2015/sep/23/developing-poor-countries-de-develop-rich-countries-sdgs>.
- Lehrer, Jonah. *How We Decide*, Mariner Books, 2010.
- Maboloc, Christopher Ryan. "Eudaimonia and Human Flourishing" in *Ethics and Human Dignity*, 15-23, Rex Bookstore, 2010.
- McNamara, Daniel J. in "A Return to the Beginning," in *Stellar Origins, Human Ways: Readings in Science, Technology, and Society*, ed. Ma. Assunta Cuyegkeng, Quezon City: Ateneo de Manila University Press, 2011.
- Rodriguez, Socorro M. "Philippine Science and Technology: Economic, Political and Social Events Shaping Their Development," 1996
- Von Baeyer, Hans Christian, *Information: The New Language of Science*, Harvard University Press, 2005.

Suggested Readings

- Agro-ecology: What it is and what it has to offer? Is this the future of farming?
- Alan Turing: The Enigma” (Andrew Hodges and Douglas Hofstadter)
- Aristotle, Nichomachean ethics, Book VI and Book X
- Article: “Environmental Impacts of Nanotechnology and Its Products” (Zhang et. Al Proceedings of the 2011 Midwest Section Conference of the American Society for Engineering Education, 2011)
- Article: “Nanoethics: The ethical and Social Implications of Nanotechnology” (Patrick Lin and Fritz Allhoff, Hoboken, New Jersey: John Wiley and Sons, Inc. 2007)
- Flowcharts/revival-west/the-age-enlightenment
 - <http://www.flowofhistory.com/readings-flowcharts/revival-west/the-age-enlightenment/fc97>
 - <http://www.flowofhistory.com/readings-flowcharts/revival-west/the-age-enlightenment/fc98>
 - <http://www.flowofhistory.com/readings-flowcharts/revival-west/the-age-enlightenment/fc99>
 - <http://www.flowofhistory.com/readings-flowcharts/revival-west/the-age-enlightenment/fc100>
 - <http://www.flowofhistory.com/readings-flowcharts/revival-west/the-age-enlightenment/fc100a>
 - <http://www.flowofhistory.com/units/west/15/FC101>
 - <http://www.flowofhistory.com/%5Bmenupathalias%5D/fc102>
 - <http://www.flowofhistory.com/units/west/15/FC103>
- Government Documents: 1. NEDA. National Development Agenda; Regional Agenda
 - <http://www.dbm.gov.ph/wp-content/uploads/GAA/GAA2015/GAA%202015%20Volume%20I/NEDA/NEDA.pdf>
 - http://www.dbm.gov.ph/wp-content/OPCCB/OPIF_2007/neda3.pdf
- Kuhn, Structure of Scientific Revolution
(http://projektintegracija.pravo.hr/download/repository/Kuhn_Structure_of_Scientific_Revolutions.pdf)
- Philosophy of Science (Encyclopedia). Scientific Progress, Scientific Revolutions (<http://plato.stanford.edu/entries/scientific-progress/#SciPro>) (http://www.encyclopedia.com/topic/Philosophy_of_science.aspx#3)
(http://www.encyclopedia.com/topic/Scientific_Revolutions.aspx#3)
- Physics of the Future: How science will shape human destiny and our daily lives by the year 2100 (Michio Kaku, Doubleday, 2011)
- Article: “The politics of Golden Rice” (Dubock, Adrian GM Crops & Food. Jul-Sep2014, Vol5 Issue 3 p 210-222 13p.)

Website/Videos/Film Clips

- Dayrit, Fabian M. Ppt: Can we build a culture of science through nanotechnology? (2013)
- Film: Akira Kurosawa's Dreams "Village of the Watermills"
- <http://www.history.com/topics/enlightenment/videos/mankind-the-story-of-all-of-us-scientific-revolution>
- <http://www.flowofhistory.com/readings>
- <http://hti.osu.edu/scientific-revolution/lesson-plans>
- <http://www.theguardian.com/global-development-professionals-network/2015/sep/23/developing-poor-countries-develop-rich-countries-sdgs>
- <http://news.bbc.co.uk/2/hi/technology/6432307.stm>, The ethical dilemmas of robotics
- <http://www.theatlantic.com/magazine/archive/2008/07/Is-google-making-us-stupid/306868/>, Is Google Making Us Stupid? 2008. Nicholas Carr
- <http://www.cc.gatech.edu/computing/nano/documents>, Why The Future Doesn't Need Us (2000) – Bill Joy, Chief Scientist and Corporate Executive Officer of Sun Microsystems
- <https://explorable.com/scientific-reductionism>
- <https://explorable.com/what-is-a-paradigm>
- Movie: "A.I." Isaac Asimov, "I Robot"
- Movie Clip (youtube): The Magician's Twin: CS Lewis and the case against Scientism
- Martin Heidegger, The Question Concerning Technology
- UNEP, That Sugar Film (2015) (documentary) Ppt: towards a green economy: pathways to sustainable development and poverty eradication
- Video: Stephen Colbert's interview with Neil Tyson <https://www.youtube.com/watch?v=YXh9RQCvxmg&noredirect=1>
- Youtube: World's Greatest Inventions (3 minutes)
- Youtube: Science Friction: Stem Cell Research
- TED Talk: Juan Enriquez on "The Next Species of Human"
- TEDTalk: Julian Assange on "Why the World Needs Wikileaks"
- TED Talk: Ray Kurzweil on "How Technology Will Transform Us"
- TEDTalk: Susan Lim on "Transplant Cells Not Organs"

Class Materials

- Activity Report: A day without Technology
- Activity Report: Timing your Technology
- Activity Report: Technology and Past (interviews with elders)