

COURSE INFORMATION					
Course Title	Code	Semester	L+P Hour	Credits	ECTS
Critical Thinking and Scientific Research Methods	PHYS 685	2	2 + 0	2	4

Prerequisites	
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Language of Instruction	English
Course Level	Postgraduate
Course Type	Elective
Course Coordinator	
Instructors	
Assistant	
Goals	To teach students how to reason rationally, write sound and effective arguments, connect critical thinking with everyday problem solving, develop intellectual and ethical traits and carry out research in accord with the scientific method.
Content	Critical thinking and its relation to science and humanism, argument mapping, egocentrism and sociocentrism, rational and irrational arguments, logical and formal fallacies, excellence of thought, questioning, scientific philosophy, the scientific method, truth-belief-hypotheses & science

Learning Outcomes	Teaching Methods	Assessment Methods
1) Human thinking left to itself leads to various forms of self-deception. Learning how to think, rather than what to think.	1,12	A
2) To distinguish between scientific thought and nonscientific thought. To recognise egocentrism and sociocentrism as being 'counter' to scientific thought.	1,2,3,12	A,C
3) To understand that questioning is a fundamental component in scientific thought.	1,12	A
4) To be aware of the categories of questions to ask that will lead to excellence of thought	1,2,3,12	A
5) To develop the ability to map arguments effectively, avoiding logical fallacies.	1,2,3,12	A,C
6) To recognise and produce a good argument. To recognise what invalidates an argument and how to repair it. To learn to reflect and reason well.	1,2,3,12	A

7)To be aware of tone, balance and bias in texts		A,C
8) To be familiar with informal fallacies, and their pitfalls.	1,2,3,12	A
9) To learn the eight elements of thought, and nine main intellectual standards	1, 2,3	A,C
10) The development of intellectual traits and ethical thinking	3,12	A
11)To recognise important philosophers of science, their thinking and methods and how their contributions aided the development of the 'scientific method'.	1	A
12)How scientific philosophy and method affects scientific research.	1	A

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Discussion, 9: Simulation, 12: Case Study
Assessment Methods:	A: Testing, C: Homework

COURSE CONTENT		
Week	Topics	Study Materials
1	Components of critical thinking and ordinary thinking, humanism, bigotry and bias	Lectures, 1,6
2	Critical thinking in scientific research	Lectures, 2,6
3	Argument mapping 1- components of a simple argument, mapping logic	Lectures
4	Argument mapping 1-case study 1	Lectures
5	Argument mapping 2-multiple premises, co-premises, the golden rule, the rabbit rule, holding hands rule. Logical fallacies.	Lectures
6	Argument mapping 2-case study 2	Lectures
7	Egocentrism and sociocentrism as results of 'ordinary' thinking	Lectures, 1
8	Classifying arguments: case studies, repairing arguments.	Lectures, 5
9	Informal fallacies: case studies, tone, balance and bias in texts.	Lectures, 5
10	Analysing the universal elements of human reasoning, the intellectual standards, excellence of thought: Application of the intellectual standards to the elements of thought	Lectures, 1
11	Standards for thinking: ethical thinking, Categories of questions, questions that lead to good thinking, socratic questioning.	Lectures,1

12	Scientific philosophy: From Alhazen to Karl Popper's hypothetico-deductive method, inductive and deductive reasoning, the correspondence theory of truth and the three worlds	Lectures, 2, 3,4
13	The scientific method and its affect on scientific research.	Lectures, 2

RECOMMENDED SOURCES	
Textbook	1. Critical thinking, 3rd edn – R. Paul and L. Elder; 2. Philosophical Concepts in Physics: The Historical Relation between Philosophy and Scientific Theories, J. T. Cushing (1998)
Additional Resources	3.An Introduction to Logic and Scientific Method, M. R. Cohen, E. Nagel(2003), 4. A Beginner's Guide to Scientific Method, S. S. Carey, (2011)

MATERIAL SHARING	
Documents	5. Coursework material from media, 6.Developing critical thinking skills, W.T. Daly
Assignments	Four homework assignments
Exams	Two mid-term exams and one final

ASSESSMENT		
IN-TERM STUDIES	NUMBER	PERCENTAGE
Mid-terms	2	30
Lab practicals	0	0
Assignment	5	15
Seminars	1	5
Total		50
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		50
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		50
Total		100

COURSE CATEGORY		Expertise/Field Courses				
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Gets a sound base for the main fields of physics such as Classical Mechanics, Quantum Mechanics and Electromagnetism,		X			

2	Gets the ability of interpreting, analysing, forming a synthesis and relationships between the main fields of physics and/or other sciences,					X
3	Obtains the education required for the measurements in scientific and technological areas and the contribution of physics in the industrial applications and on the macroscopic scale such as the society,					X
4	Follows the up-to-date scientific developments, makes the analysis/synthesis for the new ideas and evaluates them,					X
5	Uses the academic sources, the computer technology and the related devices,					X
6	Joins the working and research groups, also the scientific meetings, communicates well at the national and international level,		X			
7	Gets the ability of creative and critical thinking, problem solving, researching, producing a new and original work, improving himself/herself in his/her own fields of interest,					X
8	Gains the concepts of ethics and responsibility. Undertakes the responsibility for the solutions to the problems related with his/her field as required for having an intellectual identity.					X

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 16x Total course hours)	16	2	32
Hours for off-the-classroom study (Pre-study, practice)	16	3	48
Mid-terms	2	2	4
Homework assignments	5	3	15
Final examination	1	2	2
Total Work Load			101
Total Work Load / 25 (h)			4.04
ECTS Credit of the Course			4

