Centre For High Energy Physics
Faculty of Science
University of the Punjab, Lahore
Course Outline

Program	BSCP	**Course Code**	NHPY-110	**Credit Hours**	3
Course Title	**What is Science?**				

Course Introduction

This course introduces various fields of natural science, how scientists operate within these fields, what methods they deploy to make new discoveries, and how they communicate the advances in their fields to the world.
The course starts with and an introduction to logic and the development of scientific approach. It discusses the modern use of the scientific method and the tools that scientists deploy to ensure that they produce authentic knowledge. Students are then introduced to the main branches of science including physics, chemistry and biology, their core underlying principles, major developments in these fields and their applications in modern life. Students will work on case studies to understand how scientists discover various workings of nature and check errors if these arise in their work. The final part of the course focusses on the skills to separate valid science from pseudoscience. Students are also exposed to the fundamentals of science communication and strategies to identify reliable bodies of knowledge.

Learning Outcomes

On the completion of the course, the students will be able to

1. Clearly articulate he development of scientific thought through various parts of human history and compare it to the modern scientific method.
2. Describe various branches of science, their underlying core ideas, and compare their applications.
3. Using case studies and demonstrations, practice application of the scientific method in the natural sciences.
4. Determine whether a given claim or belief is scientifically valid or not, and provide a clear rationale for doing so.

Course Content		**Assignments/Readings**
Week 1	Logic	Chalmers 4th ed, p.39-40
	Explanation: hypothetic deductive method	Carey 4th ed., p.3-5,p.29-36
Week 2	Observations, predictions and determinism	Carey, p.9-17, 36-37
	Inductive reason	Chalmers chapter 4
Week 3	Objectivity and universality; using instruments	Carey p.9-17, p. 69-71
	Aim of science: find testable and tested explanations, predictability	Chalmers ch.5
Week 4	Inquiry about natural world in antiquity	HEC TM week 2
	Science in the medieval era: China, South Asia	HEC TM week 3
Week 5	Science in the Muslim middle east	HEC TM week 3
	Science in the Medieval Europe	HEC TM week 4

Week 6	Science in early Modern Europe	HEC TM week 4
	Modern science: Science change and extended theories	Hawkings, chapter 3 (first 3 pages)
Week 7	Facts, models, laws and theories	Chalmers, p.1-5, 9-14, Gordon p.106-110, Carey p.38-39, Hawkings, chapter 3 (first 3 pages), Chalmers p.97-100
	Physics and its sub-branches	HEC TM week 6
Week 8	Classical Physics	HEC TM week 7
	Modern Physics	HEC TM week 8
Week 9	Chemistry and its sub-branches	HEC TM week 6
	Chemistry	HEC TM week 9
Week 10	Earth science-I	HEC TM week 10
	Earth science-II	HEC TM week 10
Week 11	Biology and its sub branches	HEC TM week 6
	Biology	HEC TM week 11
Week 12	Evolution	HEC TM week 11
	Natural selection	HEC TM week 11
Week 13	Cells in biology	HEC TM week 12
	Genes, DNA and RNA	HEC TM week 12
Week 14	Photosynthesis and Ecosystem	HEC TM week 12
	Scales and levels in biology, levels of reality	HEC TM week 12 Chalmers, p.264-266
Week 15	Fallacies in the name of science	HEC TM week 13 Carey, chapter 6
	Pseudoscience	HEC TM week 14 Carey, p.123-128
Week 16	Science communication, Science journals	HEC TM week 15
	Pure and applied science, use of science, role of values in science	Carey, p.5-7, Cartwright, p.162-166

Textbooks and Reading Material

1. Textbooks:

a) "*What is This Thing Called Science?*" by A. F. Chalmers. Publisher: UQP. 4th ed. 2012.
b) "*A Beginner's Guide to the Scientific Method*" by S.S. Carey, Wadsworth, 4th ed. 2011.
c) HEC Teacher's Manual (Natural Sciences) for "What is Science?", 2021.

2. Suggested Readings

- "A Briefer History of Time" by S. Hawking and L. Mlodinow, Bantam Books,2005.
- "The History and Philosophy of Social Science" by Gordon, S. Routledge, 1991.

- "Philosophy of Social Science", Cartwright, N and Montuschi, E. (Ed.), Oxford University Press, 2014.

Teaching Learning Strategies

1. Asking students for what they have learnt and what do they think
2. Group activities
3. Using video resources
4. Reading suggested readings
5. Essay writing

Assignments: Types and Number with Calendar

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.