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| Paper Code | NHPY-110 | Cr. Hrs. | 03 |
| Paper Title | What is Science? | | |
| Domain | Natural Sciences | | |

| Course Introduction | | |
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| <ul style="list-style-type: none"> ◆ 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 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 | | |
| <p>On the completion of the course, the students will be able to</p> <ol style="list-style-type: none"> 1. Clearly articulate the 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 |
| Week1 | Logic | Chalmers 4 th ed, p.39-40 |
| | Explanation: hypothetic deductive method | Carey 4 th ed., p.3-5, p.29-36 |
| Week2 | Observations, predictions and determinism | Carey, p.9-17, 36-37 |
| | Inductive reason | Chalmers chapter 4 |
| Week3 | Objectivity and universality; using instruments | Carey p.9-17, p.69-71 |
| | Aim of science: find testable and tested explanations, predictability | Chalmers ch.5 |
| Week4 | Inquiry about natural world in antiquity | HECTM week 2 |
| | Science in the medieval era: China, South Asia | HECTM week 3 |
| Week5 | Science in the Muslim middle east | HECTM week 3 |
| | Science in the Medieval Europe | HECTM week 4 |
| | Science in early Modern Europe | HECTM week 4 |
| Week 6 | Modern science: Science change and extended theories | Hawkings, chapter 3 (first 3 pages) |
| Week7 | Facts, models, laws and theories | Chalmers, p.1-5, -14, Gordon p.106-110, Carey p.38-39, Hawkings, chapter 3 (first 3 pages), Chalmers p.97-100 |

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| | Physics and its sub-branches | HECTMweek6 |
| Week8 | Classical Physics | HECTMweek7 |
| | Modern Physics | HECTMweek8 |
| Week9 | Chemistry and its sub-branches | HECTMweek6 |
| | Chemistry | HECTMweek9 |
| Week10 | Earth science-I | HECTMweek10 |
| | Earth science-II | HECTMweek10 |
| Week11 | Biology and its sub branches | HECTMweek6 |
| | Biology | HECTMweek11 |
| Week12 | Evolution | HECTMweek11 |
| | Natural selection | HECTMweek11 |
| Week13 | Cells in biology | HECTMweek12 |
| | Genes, DNA and RNA | HECTMweek12 |
| Week14 | Photosynthesis and Ecosystem | HECTMweek12 |
| | Scales and levels in biology, levels of reality | HEC TM week 12 Chalmers,p.264-266 |
| Week15 | Fallacies in the name of science | HEC TM week13 Carey,chapter6 |
| | Pseudo science | HEC TM week 14Carey,p.123- 128 |
| Week16 | Science communication, Science journals | HECTMweek15 |
| | Pure and applied science, use of science, role of values in science | Carey, p.5-7, Cartwright,p.162-166 |

Text books and Reading Material

1. Textbooks:

- i. *“What is This Thing Called Science?”* by A.F. Chalmers. Publisher: UQP. 4thed. 2012.
- ii. *“A Beginner’s Guide to the Scientific Method”* by S. S. Carey, Wadsworth, 4thed. 2011.
- iii. HEC Teacher’s Manual (Natural Sciences) for “What is Science?”, 2021.

2. Suggested Readings

- i. *“A Briefer History of Time”* by S. Hawking and L. M lodinow, Bantam Books, 2005.
- ii. *“The History and Philosophy of Social Science”* by Gordon,S. Routledge,1991.
- iii. *Philosophy of Social Science”, Cartwright, Nand Montuschi, E.(Ed.), Oxford University Press, 2014.*