1	Name of Course Module: **History and Philosophy of Science-2**
2	Course Code:
3	Name(s) of academic staff: Prof. C. K. Raju
4	**Rationale for the inclusion of the course/module in the programme:** **1.** Part 1 of the History and Philosophy of Science (HPS1) course is a little too short, being only one trimester. Many students get interested and want to pursue the matter further. Accordingly, there is a need to go into greater details so that the students' understanding of certain key but difficult topics is deepened and consolidated. 2. The course is thus built around topics touched upon in the HPS1 course but not developed in enough 3. The further objective of the course is to help students understand how a bad history and philosophy of science affects their everyday lives and minds, especially through the education system.
5	Semester and Year offered:

6	Total Student Learning Time (SLT)	**L**	**T**	**P**	**O**	Total Guided and Independent Learning
	L=Lecture, T=Tutorial, P=Practical O=Others [Projects / Assignments / Consultation / Library Searches / E-learning / Self-study / Independent study / Preparation / Field Work, etc.]	36		0	84	120

7	Credit Value: 03
8	**Prerequisite (if any):** History and Philosophy of Science, course 1
9	Learning outcomes (LOs)*: At the end of the course, students will be able to: LO1. Comprehend how specific philosophies of mathematics and science have been normatively used to defend the belief that science is of Western origin. [C1, C2, C5, A1, A2, A3] LO2. Recognize possible metaphysical biases in those beliefs which are globalised by the colonial education system. Distinguish between global and truly universal. [C1, C2, A2, A3, A5] LO3. Criticise the stock philosophies of mathematics and science through alternative philosophies of mathematics and science, and illustrate the societal consequences of adopting alternative philosophies. [C3, C5, A1, A3] LO4. Comprehend that technology impacts daily life both positively and negatively, and apply ethics to avoid the negative consequences and associated risks. [C2, C3, A2, A5]
	***Cognitive domain:** Knowledge [C1], Comprehension [C2], Application [C3], Analysis [C4], Synthesis [C5], Evaluation [C6] ***Affective domain:** Receiving [A1], Responding [A2], Valuing [A3], Organization [A4], Internalizing [A5] ***Psychomotor domain:** Perception [P1], Set [P2], Guided Response [P3], Mechanism [P4], Complete Overt Response [P5], Adaptation [P6], Organization [P7]
10	Transferable Skills: Students acquire the following: • deeper knowledge of discipline areas • practical skills • problem solving and scientific skills
11	Teaching-learning and assessment strategy*:

	Learning Outcome	Teaching and Learning Strategy	Assessment Strategy
	LO1: Comprehend how specific philosophies of mathematics and science have been normatively used to defend the belief that science is of Western origin. [C1, C2, C5, A1, A2, A3]	Lecture Literature Reviews Group discussions [MQA 1,3,4,5,6,7,8; MoHE1,2,3,4,5,6,7]	Assignment Mid-term examination Final Examination
	LO2: Recognize possible metaphysical biases in those beliefs which are globalised by the colonial education system. Distinguish between global and truly universal. [C1, C2, A2, A3, A5]		
	LO3: Criticise the stock philosophies of mathematics and science through alternative philosophies of mathematics and science, and illustrate the societal consequences of adopting alternative philosophies. [C3, C5, A1, A3]	Lecture Inquiry Reading [MQA 1,3,4,5,6,7,8; MoHE1,2,3,4,5,6,7]	Assignment Mid-term examination Final Examination
	LO4: Comprehend that technology impacts daily life both positively and negatively, and apply ethics to avoid the negative consequences and associated risks. [C2, C3, A2, A5]	Practical Internet Search Group Discussions [MQA 1,3,4,5,6,7,8; MoHE1,2,3,4,5,6,7]	Assignment Mid-term examination Final Examination

*MQA Domains of Learning Outcomes: Knowledge of Discipline Areas [MQA1], Practical Skills [MQA2], Social Skills & Responsibilities [MQA3], Values, Attitudes & Professionalism [MQA4], Communication, Leadership & Team Skills [MQA5], Problem-solving & Scientific Skills [MQA6], Managerial & Entrepreneurial Skills [MQA7], Information Management & Lifelong Learning Skills [MQA8]

*MOHE/ LOKI Soft Skill Learning Outcomes: Communication Skills [MOHE1], Critical Thinking and Problem solving Skills [LOKI2], Information and Lifelong Learning [MOHE3], Team Work Skills [MOHE4], Entrepreneurial Skills [MOHE5], Values, Ethics and Professionalism [MOHE6], Leadership Skills [MOHE7]

12	Synopsis The course aims to help students acquire a deeper understanding of how a bad history and related globalised philosophy of science affects their everyday lives and minds, especially through the education system.
13	Mode of Delivery: Lecture, Guest Speaker, Internet Search, Literature Reviews, Inquiry Reading, Group Discussion, Discovery Learning,
14	Assessment methods and types:

Formative Assessment/ Summative Assessment
Self-Assessment [SA] / Peer-Assessment [PA] / Lecturer Assessment [LA]
Individual Assessment [IA] / Group Assessment [GA]

Method	LO	Type		Weight
Assignment 1	LO1 – LO2	Formative	SA/PA/LA	15
Assignment 2	LO3	Formative	SA/PA/LA	15
Mid-term Examination	LO1 – LO2	Formative/ Summative	IA/LA	35
End Term Examination	LO1 – LO4	Summative	IA/LA	35
Total				**100**

Content outline of the course/module content and the SLT per topic.						
Course module topics	**LO**	L=Lecture, T=Tutorial, P=Practical O=Others [Projects / Assignments / Consultation / Library Searches / E-learning / Self-study / Independent study / Preparation / Field Work, etc.]				
		L	**T**	**P**	**O**	**SLT**
Week 1 How history of science links to the philosophy of science. Specific examples such as how the history of Euclid links to the philosophy of mathematics as deductive proof. Understand the difference between empirical and deductive proofs. The use of empirical proofs worldwide and in the *Elements*.	LO1	3			6	9
Week 2 How philosophy of science leads to normative universality and justifies biases. **a.** Understanding the difference between normative and factual universality. Examples to illustrate the difference. **b.** Understanding how the philosophy of science leads to normative universality: for example, deductive proofs were normatively universal, not factually so.	LO2/ LO3	3			6	9
Week 3 How philosophy of science leads to normative universality and justifies biases (continued) **c.** Understand how normative universality is used to defend biases: for example, how the demand for deductive proof was historically used to reject all non-Western mathematics as inferior. Recent example of how the demand for belief in laws of nature and causality is being used against Islam. **d.** Actual historical origin of these normative beliefs.	LO2/ LO3	3			6	9
Week 4 How the philosophy of science globalises normative universality and its biases through the colonial education system. **a.** The philosophy of summing infinite	LO2/ LO3	3			6	9

	series of the calculus as it originated in India, vs Newton's fluxions vs the philosophy of limits in present-day university courses on calculus. **b.** Brief idea of the effect of the philosophy of infinity on science, as in Stephen Hawking's singularity theory.						
	Week 5 How the philosophy of science globalises normative universality and its biases through the colonial education system (continued) **c.** Notion of causality, its effect on the criterion of refutability, Popper's pond paradox. **d.** What does science give? Laws of nature vs habits or fallible models. **e.** Kuhn's theory of paradigm shifts and how it can be engineered through a false history of science.	LO2/ LO3	3			6	9
	Week 6 Alternative philosophies of science. What possible effect would they have on science and society. Alternative philosophies of mathematics. Alternative notions of causality and its consequences for physics.	LO2/ LO3	3			6	9
	Week 7: Exam						6
	Week 8 Alternative philosophies of science. What possible effect would they have on science and society. Alternative philosophies of mathematics. Alternative notions of causality and its consequences for physics.	LO2/ LO3	3			6	9
	Week 9 Is technology something always to be welcomed? Cost benefit analysis of some technologies. The rush for technology from cars to mobile phones and some of its undesirable consequences.	LO2/ LO3	3			6	9
	Week 10 Is technology something always to be welcomed? Cost benefit analysis of some technologies. The rush for technology from cars to mobile phones and some of its undesirable consequences.	LO2/ LO3	3			6	9
	Week 11 Ethics of science. Various issues, such as plagiarism. Are claims of independent rediscovery justified in a historical context? Examples of Copernicus, Darwin, Einstein, Edison. What constitutes significant innovation? Intellectual	LO2/ LO3	3			6	9

	property, patents, open source software development. Science is based on past knowledge, so is it valid to do science secretively? Is it valid to reap benefits from technology and pass on the costs to others? Falsification and bad statistical analysis of experiments. Historical and contemporary examples. How can scientific ethics be ensured?						
Society. Are claims of independent rediscovery justified in a historical context? patents, past knowledge, to reap benefits Falsification Historical be ensured?	**Week 12** Ethics of science. Various issues, such as plagiarism. Are claims of independent rediscovery justified in a historical context? Examples of Copernicus, Darwin, Einstein, Edison. What constitutes significant innovation? Intellectual property, patents, open source software development. Science is based on past knowledge, so is it valid to do science secretively? Is it valid to reap benefits from technology and pass on the costs to others? Falsification and bad statistical analysis of experiments. Historical and contemporary examples. How can scientific ethics be ensured?	LO2/ LO3	3			6	9
Society. Are claims of independent rediscovery justified in a historical context? patents, past knowledge, to reap benefits Falsification Historical be ensured?	**Week 13** Ethics of science. Various issues, such as plagiarism. Are claims of independent rediscovery justified in a historical context? Examples of Copernicus, Darwin, Einstein, Edison. What constitutes significant innovation? Intellectual property, patents, open source software development. Science is based on past knowledge, so is it valid to do science secretively? Is it valid to reap benefits from technology and pass on the costs to others? Falsification and bad statistical analysis of experiments. Historical and contemporary examples. How can scientific ethics be ensured?	LO2/ LO3	3			6	9
	Week 14: Exam						6
	Total Hours		**36**			**84**	**128**

18	Readings selected from the following texts (indicative):
	K. R. Popper, The Logic of Scientific Discovery, Routledge classics, 2002.
	K. R. Popper, Realism and the Aim of Science, vol 1, Hutchinson, London, 1981.
	T. S. Kuhn, The Copernican Revolution, Princeton Univ. Press, 1957.
	T. S. Kuhn, The Structure of Scientific Revolutions, Chicago Univ. Press, 1962.
	C. K. Raju, The Eleven Pictures of Time, Sage, 2003.
	C. K. Raju, Cultural Foundations of Mathematics, Pearson, 2007.
	Bruno Latour, "Technology is society made durable", in John Law (ed.) A Sociology of Monsters: Essays on Power, Technology and Domination. Routledge, London, pp. 103-131.
	M. Adas, Machines as the measure of men: science, technology and ideologies of Western dominance, Cornell UP, 1992.
19	Other additional information: Nil.