

M Ed Two Year Programme

S.Sc. 1 (e) : Introduction to Science Studies

Maximum Marks: 100

This course aims to develop an understanding of the processes of science and technology and their relationship with society and the environment. It exposes students to a selection of writings (and films/videos) by historians, sociologists and scientists, to see how ideas have developed, through contestations or collaborations, shaped by social, historical, political and cultural influences. It also looks at the emergence of modern science in India, influenced by colonialism and the national struggle for independence; the role of citizen science and people's science movements for social transformation. The course addresses issues of equity and diversity, through feminist and multicultural perspectives that allow a relook at the discipline as well as its reflection in the school curriculum.

This course can be of interest to any M.Ed. I year student (having a basic background in school science) wishing to understand the field from a historical, sociological, cross-cultural, and inter-disciplinary perspective; it will, however, be essential for all those who wish to specialise in Science Education in the second year.

Unit 1 The Process of Science

- What is the process of science? Is there a 'scientific method'? Reflecting on one's own initiation into science; auto/biographical writings of scientists doing science;
- Some histories of science that shaped ideas about humans – the mesmerizing journey of the 'unconscious' (Miller); the 'mismeasure' of intelligence, and 'imageries of evolution'(Gould); neurons and empathy, and the riddle of autism (Ramachandran);
- How have social, historical, political and cultural influences shaped scientists' work? What is technology? How did technicians and crafts persons shape modern science?
- Major debates and paradigm shifts in science – Galileo and heliocentric theory; Darwin and evolution; Wegener and continental drift; the nature of science and 'scientific revolutions';

Readings and Resources

- Derry, G.N. (1999). *What Science is and How it Works*. Princeton, New Jersey: Princeton University Press. Chapters I-VIII
- Conner, C. (2005) *A People's History of Science: Miners, Midwives and 'Low Mechanics'*. p 1-22, 276-294. Nation Books, New York.
- Feynman, R. (1999) *The Pleasure of Finding Things Out*. Penguin, London. p 1-25, 53-96, 141-149, 171-188. Interview video at <https://www.youtube.com/watch?v=FXiOg5-l3fk>;

- Bronowski, J. (1981). *The Ascent of Man*. London: Macdonald Futura Publishers. Chapters VI, VII, VIII, X, XII and the film series on DVD
- Hellman, H. (1998) *Great Feuds in Science: Ten of the liveliest disputes ever*. John Wiley & Sons. ('Urban VIII vs Galileo' p.1-20; 'Evolution Wars' p. 81-103; 'Wegener vs Everybody' p. 141-158)
- Ramachandran, V.S. (2010) *The Tell-Tale Brain*. Random House India, (p163-212)
 - Miller, J. *Going Unconscious*. In R.B. Silvers, R.B. (1997) (ed.) *Hidden Histories of Science*. Granta, London, (p 1-34)
 - Gould, S.J. (1964). *The Mismeasure of Man*. New York: W.W. Norton. Chapter V; also 'Ladders and Cones: Constraining evolution by canonical icons'. In Silvers, R.B. (1997) (Ed.) *Hidden Histories of Science*. Granta, London, (p 40-67)
 - Carey, J. Ed. (2003) *The Faber Book of Science*. Penguin Books India and Faber & Faber. Selections: 'The colour of radium', Eve Curie (p. 191-201); 'The secret of the mosquito's stomach', Ronald Ross (204-210); 'The man who mistook his wife for a hat', Oliver Sacks (p. 460-466); 'The story of a carbon atom', Primo Levi (p 338-344); 'The discovery of X-rays', W. Roentgen and others (p 181-187)
 - Kuhn, T. (1964). *The Structure of Scientific Revolutions*. University of Chicago Press. Chapters IV, VI, VII, VIII, IX, X
 - Boudanis, D. (2000) *E=mc²: A biography of the world's most famous equation*. Pan Books. p11-54,195-203 (on Chandrasekhar). Film available at: Part I <https://www.youtube.com/watch?v=jqiRoKy0Gyo> Part II <https://www.youtube.com/watch?v=jbmFcGhTnS0>
- BBC Documentary *The Voyage of Charles Darwin* (Parts 1-7) Part I <https://www.youtube.com/watch?v=1hoDaxVIVPE> Part VI & VII <https://www.youtube.com/watch?v=zXY-EWZU5qo>

Unit 2 Development of Modern Science

- The institutionalisation of natural philosophy; the professionalisation of science after the industrial revolution, distancing 'pure, academic science' from technology; science and warfare; concerns about social responsibility; dealing with socio-scientific issues
- The emergence of modern science in India; colonialism and nationalist science; review of the Green Revolution; everyday technology in the making of modern India;
- the role of 'scientific temper' and citizen science; people's science movements in India
- academic science and 'post-academic science' - new modes of knowledge production; organization and collectivization; funding; intellectual property vs knowledge commons;

Readings and Resources

- Aikenhead, G.S. and Solomon, J. (Eds.) (1994) *STS Education: International Perspectives on Reform*. New York: Teachers College Press. Chapter II
- Aikenhead, G.S. (2006) *Science Education for Everyday Life*. Teachers College Press. Chapters II, III, VII
- Chakrabarti, P. (2010) 'Science and *Swadeshi*: The Establishment and Growth of the Bengal Chemical & Pharmaceutical Works', in Uma Das Gupta (ed), [*Science and Modern India: An Institutional History c.1784-1947*](#), Pearson Education, New Delhi.
- Shiva, V. (1993) *The Violence of the Green Revolution*. Third World Network. Accessed from <http://www.trabal.org/courses/pdf/greenrev.pdf>;
- Making Peace with the Earth (2010) Sydney Peace Foundation Lecture http://sydneypeacefoundation.org.au/wp-content/uploads/2012/02/2010-SPP_Vandana-Shiva1.pdf
- Arnold, D. (2013) *Everyday Technology: Machines and the Making of India's Modernity*. University of Chicago Press. Chapters III and V.
- Bhargava, P. M. and Chakrabarti, C. (2010) *Angels, Devil and Science: A Collection of Articles on Scientific Temper*, National Book Trust, New Delhi, India.
- Mahanti, S. (2013) A Perspective on Scientific Temper in India, *Journal of Scientific Temper*, Vol 1, 1 &2,46-62
- Varma, R. (2001) People's Science Movements and Science Wars? *Economic and Political Weekly*, Dec 29. p4796-4802
- Alexis de Greiff A. and Olarte, M.N.(2006) What we still do not know about South-North technoscience exchange. In R.E. Doel and T. Soderqvist (Eds) *The Historiography of Contemporary Science, Technology and Medicine*. Routledge, New York p.239-50
- Ziman, J. (2000) *Real Science: What it is, and what it means?* Cambridge University Press. (pages 12-74)

Unit 3 Democratising Science and its Education

- Multicultural science as socially and culturally constructed;
- Feminist perspectives on democratising science; humanist science; respect and responsibility, role of traditional ecological knowledge (TEK) about relationships between living beings and the environment;
- Critical review of educational dichotomies and hierarchies – knowledge and skill, academic and vocational, 'pure' and applied; historical dominance of the 'academic' school curriculum over 'science of the common things';
- What science for *all*? Critical reading of international debates on the aims of school science; place-based science education, implications for equity and justice;

Readings and Resources

- Aikenhead, G.S. (2006) *Science Education for Everyday Life*. Teachers College Press, N.Y. p 1-23, 107-127
- Kourany, J. (2010) *Philosophy of Science after Feminism*. Oxford University Press. p3-20

- Maddox, B. (2002) *Rosalind Franklin: The Dark Lady of DNA*. Harper Collins, London. p165-213.
- Lee, O. and Buxton, C. (2010) *Diversity and Equity in Science Education*. Teachers College Press. p23-35 (chapter 2- Conceptual grounding and policy context)
- Hodson, D. (1988). 'Science curriculum change in Victorian England: A Case Study of the Science of Common Things.' In *International Perspectives in Curriculum History*. London, Routledge
 - Rampal, Anita, & Mander, H. (2013) Lessons on Food and Hunger: Pedagogy of Empathy for Democracy. *Economic & Political Weekly*, 48(28), 51–57.
 - Slaton, A. And Calabrese Barton, A. (2011) 'Respect and Learning'. In B. Fraser, K.G. Tobin and C.J. McRobbie, (Eds.) *The Second International Handbook of Science Education*, Springer. p513-526