



गुजरात केन्द्रीय विश्वविद्यालय
CENTRAL UNIVERSITY OF GUJARAT

**CENTRE FOR STUDIES AND RESEARCH IN SCIENCE, TECHNOLOGY
AND INNOVATION POLICY (CSRSTIP)
SCHOOL OF SOCIAL SCIENCES (SSS)
CENTRAL UNIVERSITY OF GUJARAT**

SYLLABUS

MPhil-Ph. D. Programme in Studies in Science, Technology and Innovation
Policy

MPHIL COURSE CREDIT STRUCTURE

<i>SEMESTER – I</i>	Credits	<i>SEMESTER – II</i>	Credits
Paper – 1: Research Methodology – I	02	Paper – 1: Research Methodology - II	02
Paper – 2	03	Paper – 2	03
Paper – 3	03	Paper – 3	03
Term Paper/Assignment	01	Term Paper/Assignment	01
Seminar	01	Seminar	01
Total Credits	10	Total Credits	10
<i>SEMESTER – III</i>			
Dissertation	20		
Total Credits Required for the Programme of Study: 40 (Minimum)			

DETAILS OF THE COURSES

Monsoon Semester- I

Course Number	Paper	Credits
STI 601	Research Methodology I	02
STI 602	Introduction to Science, Technology, and Society (STS) Studies	03
STI 603	Innovation and Socio-Economic Change	03
STI 641	Term paper/Assignment	01
STI 642	Seminar	01

Winter Semester-II

Course Number	Paper	Credits
STI 651	Research Methodology II (<i>Technology Futures Analysis</i>)	02
STI 652	Science and Technology in Modern India	03
	Optional Papers	
STI 671	Intellectual Property Rights and Development	03
STI 672	Science and Technology Policy Analysis	03
STI 673	Science Communication: Approaches and Methods	03
STI 674	Philosophy of Science and Technology	03
STI675	Science, Technology and Environment	03
STI 691	Term paper/Assignment	01
STI 692	Seminar	01

Course Code: Core-1, Optional-2, Field Work/Practicals-3, Non-Credit-4, Repeat-5, Dissertation-6

Minimum credits per semester (for course work): 10

* New Course Numbers as per Office Order of CoE dated 8-11-2016 (F.No. 8-1/2011-admn&Eval./5305)

SYLLABUS

COMPULSORY COURSES

Course No: STI 601

RESEARCH METHODOLOGY-I

Semester I/ Paper I

(Credits: 02)

Course objective

The course intends to provide a sound understanding of the philosophical foundations of natural and social sciences. Students will also learn methods and techniques of qualitative research.

Course description

The course is divided into three sections; the first section introduces the philosophy of science and different traditions of theory of knowledge. The second section's emphasis is on the philosophy of social sciences and ethics of research, as well as methodological issues in doing historical research. The third section discusses the designing of research in detail and introduces the techniques and methods used in social science research.

Mode of Evaluation

Book and article reviews and assignments in connection with different research techniques (Weightage: 50%). There will also be an End Semester examination (Weightage: 50%). 85 % of attendance is required. Participation in class room discussions and activities is mandatory.

Method of Instruction

Lecture/seminars/ classroom exercises/tutorials

UNITS

1. Introduction to Philosophy of Science

- a. Aristotle's Philosophy of Science---The Pythagorean Orientation---Atomism---Seventeenth century attack on Aristotlean Philosophy---Galileo, Bacon, Descartes, Newton--- Epistemology---Theories of knowledge---Historicism---Empiricism---Rationalism--- Inductivism vs. Hypothetico-Deductive View of Science
- b. Positivism, Neo-Positivism & Logical Positivism: Contributions of Comte, Durkheim, Vienna School---Debates over Scientific Realism---Constructivism
- c. Perspectives and Debates on the Nature of the Scientific Method---Debates on the notions of progress in Science--Karl Popper's notion of Falsification-Thomas Kuhn's notion of Paradigm and Scientific Revolution-Imre Lakatos' Methodology of Scientific Research Programmes-Paul Feyerabend's perspective on Methodological Anarchy in Science

2. Introduction to Philosophy of Social Sciences

a. What is Social Science?

Difference between methodology and method-subject matter-quantitative and qualitative research-emergence of social sciences in India, disciplinary boundaries-multidisciplinary and interdisciplinary approaches-social sciences today

b. Understanding ‘Reality’

What is reality and how do we know it: ontological and epistemological issues-empirical data and theory- theory ladenness of observations and data-problems in understanding reality.

c. Self-Reflexivity and Ethics

Relationship between the knower and the ‘object’ of knowing-researcher’s biases and background assumptions-influence of class, caste and gender of the researcher on research-traditional vs. organic intellectuals (Gramsci)-politics of knowledge production-research as vocation and career

d. History and Historiography

- a. Methods in history-historiography--historical narratives-historical facts-archive-Social History of Science and Technology.
- b. Theory of knowledge in non-western philosophical traditions and schools-Indian debates on epistemology

3. Planning of Research

- a. The planning Process, Selection of a Problem for Research, Formulation of the Selected Problems, Hypothesis Formation, Measurement, Research Design/Plan, Research Proposal.

- b. Review of Literature

Need for Reviewing Literature, What to Review and for What Purpose, Literature Search Procedure, Sources of Literature, Planning of Review work, Note Taking

- c. Types of Research

Classification of Research, Pure and Applied Research, Exploring or Formulative Research, Descriptive Research, Diagnostic Research/Study, Evaluation Research/Studies, Action Research, Experimental Research, Analytical Study of Statistical Method, Historical Research, Surveys, Case Study, Field Studies

4. Methods of Research

- a. Scientific Methods, Hypotheses Generation and Evaluation, Code of Research Ethics, Definition and Objectives of Research, Various Steps in Scientific Research, Research Purposes – Research Design - Survey Research - Case Study Research
- b. Data Collection-Sources of Data: Primary Data, Secondary Data; Procedure Questionnaire- Survey and Experiments – Design of Survey and Experiments - Sampling Merits and Demerits - Control Observations - Procedures - Sampling Errors
- c. Fieldwork-The Nature of Field Work, Selection and Training of Investigators, Sampling Frame and Sample Selection, Field Operation, Field Administration
- d. Data Analysis-Concepts, Categories and Theory-Hypothesis testing-findings

Essential Readings

- Berger, Peter L. and Thomas Luckmann 1966. *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*, New York: Anchor Books.
- Carr, E. H. 1967. *What is History?* Vintage.
- Chalmers, A F. 1999. *What is This Thing Called Science?* Third Edition, Hackett Publishing Company.
- Feyerabend, Paul 2010. *Against Method*. Fourth Edition, Verso.
- Grbich, Carol 2004. "The Position of the Researcher", in idem. *New Approaches in Social Research*, Thousand Oaks, London & New Delhi: Sage Publications, pp. 67-79.
- Kothari, C.R. 2006. *Research Methodology Methods and Techniques*, 2nd edition, Vishwa Prakashan.
- Kuhn, Thomas 1970. *The Structure of Scientific Revolutions*, University of Chicago Press.
- Wallerstein, Immanuel et al. 1996. *Open the Social Sciences: Report of the Gulbenkian Commission on the Restructuring of the Social Sciences*, Stanford University Press.

Recommended Readings

- Bendat and Piersol 2001. *Random Data: Analysis and Measurement Procedures*, Wiley Interscience.
- Beteille, Andre 2000. "Universities as Centres of Learning", in idem. *Antinomies of Society: Essays on Ideologies and Institutions*, New Delhi: Oxford University Press, pp. 131-152
- Bloor, David 1997. "What is a Social Construct?" *Vest* 10/1: 09-21
- Collingwood 1994. *The Idea of History: With Lectures 1926-1928*, Revised Edition, OUP.
- Das, Veena 2004. "Social Sciences and the Publics", in idem. *Handbook of Indian Sociology*, New Delhi: Oxford University Press Pp. 19-40.
- Davies, Charlotte Aull 2008. "Reflexivity and Ethnographic Research", in idem. *Reflexive Ethnography: A Guide to Researching Selves and Others*, second edition, London and New York: Routledge, pp. 1-27 [CUGL 305.8007 D2R3]
- Denzin, Norman K. and Yvonna S. Lincoln (eds) 2005. *The Sage Handbook of Qualitative Research*, 3rd edition, Thousand Oaks, London & New Delhi: Sage Publications [CUGL 001.42/D3S2]
- Feyerabend, Paul 1982. *Science in a Free Society*. London: New Left Books.
- Fricker, Miranda 1994. "Knowledge as Construct: Theorizing the Role of Gender in Knowledge", in Lennon, Kathleen and Margaret Whitford (eds). *Knowing the Difference: Feminist Perspectives in Epistemology*, London and New York: Routledge, pp. 95-109 [CUGL 121.082 L3K6]
- Geertz, Clifford. 1973. "Thick Description: Toward an Interpretive Theory of Culture". In idem. *The Interpretation of Cultures: Selected Essays*. New York: Basic Books, 1973. 3-30.

- Hammersley, Martyn 2000. *Taking Sides in Social Research: Essays on Partisanship and Bias*, London and New York: Routledge
- Haraway, Donna 1988. "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective", *Feminist Studies* 14: 575-609
- Harding, Sandra 1993. "Rethinking Standpoint Epistemology: "What is Strong Objectivity?" in Alcott, Linda, and Elizabeth Potter (eds). *Feminist Epistemologies*, New York: Routledge, pp. 49-82
- Henn, Matt, Mark Weinstein and Nick Foard 2006. *A Short Introduction to Social Research*, New Delhi: Vistaar
- King, Gary, Robert O. Keohane and Sidney Verba 1994. *Designing Social Inquiry: Scientific Inference in Qualitative Research*, Princeton, Chapter 1–3.
- Lakatos, Imre 1970. "Falsification and Methodology of Scientific Research Programmes" in I. Lakatos and R. Musgrave, eds. *Criticism and the Growth of Knowledge*, Cambridge.
- Lal, Vinay 2003. *The History of History: Politics and Scholarship in Modern India*. New Delhi: Oxford University Press.
- Lewis-Beck, Michael S., Bryman, Alan and Futing Liao, Tim 2004. *The Sage Encyclopaedia of Social Science Research Methods*. New York: Sage Publications.
- Losee, John. 2001. *A Historical Introduction to the Philosophy of Science*. Oxford University Press. Fourth Edition
- Lyotard, Jean-Francois 1997 (1979). *The Postmodern Condition: A Report on Knowledge*, Minneapolis: University of Minnesota Press
- MINITAB online manual.
- Moran, Joe 2010. "Introduction", in idem. *Interdisciplinarity*, Second Edition, London and New York: Routledge
- Popper, Karl 1959. *The Logic of Scientific Discovery*, New York.
- Popper, Karl 2002. *Conjectures and Refutations: The Growth of Scientific Knowledge*, Routledge.
- Said, Edward W. 1996. *Representations of the Intellectual: The 1993 Reith Lectures*, New York: Vintage Books.
- Sarkar, Sumit 2005. "Post-Modernism and Writing of Indian History", *Beyond Nationalist Frames-Relocating Postmodernisms, Hindutva, History*, Permanent Black, Delhi, Chapter-6.
- Spivak, Gayatri Chakravarty 1988. "Can the Subaltern Speak?" in Cary Nelson and Lawrence Grossberg (eds). *Marxism and the Interpretation of Culture*, London: Macmillan, pp. 271-313.
- Srivastava, Vinay 2005. *Methodology and Fieldwork*, New Delhi: OUP.

Course No: STI 602

Introduction to Science, Technology and Society (STS) Studies

Semester I/ Paper 2

(Credits: 03)

Course objectives

The course introduces the interdisciplinary field of research, Science, Technology and Society (STS) Studies to the students. The interface between science, technology and society will be looked into from a range of theoretical perspectives.

Course description

The first part of the course introduces three basic theoretical trends that problematized production of scientific knowledge; Sociology of Scientific Knowledge (SSK), Postcolonial Studies of Science and Feminist Studies of Science. The second part of the course focuses on the technology-society interface from a wide range of theoretical standpoints such as social shaping of technology, social constructionist and actor network theoretical perspectives. The course in general proposes that science and technology are socially and culturally embedded activities.

Mode of Evaluation

Term papers, seminars, book and article reviews (weightage: 50%). There will also be an End Semester examination (Weightage: 50%). 85 % of attendance is required. Participation in class room discussions and activities is mandatory.

Method of Instruction

Lecture/seminars/tutorials

UNITS

1. Sociology of Scientific Knowledge

What is the relationship between science and the social?—Conventional view of philosophers and historians of science-Sociology of Science (Karl Mannheim-Robert K. Merton)-Social Function of Science-(Joseph Bernal)-The Radical Science Movement-the Kuhnian intervention-Science as a social activity: Strong Programme-Laboratory Studies/ethnography of science- Actor Network Theory (Bruno Latour)-communicating science to peers- scientific controversies-public engagement with S&T-the changing configuration of science- mode II knowledge production

2. Feminist and Postcolonial Studies of Science

Women in Science-Gender and Science-Has feminism changed science?-feminist epistemology-Eurocentrism-the Enlightenment-racism and science-colonial science-human body and science-Craniology and comparative anatomy in the 19th century-eugenics-caste and gender in Indian science

3. Technology – Society Interface

i. Technoscience and the Interpenetration of Science & Technology

Questioning of the traditional boundary between science (knowing) and technology (doing)—how science and technology together shape the ways in which knowledge is constructed---Technological Determinism, Power and the Politics of Knowledge Production

ii. Technology in Context: Perspectives in STS Studies

This section examines various perspectives on Technology in STS studies

- A) Social Shaping of Technology
- B) Social Construction of Technology
- C) Actor Network Theory
- D) Transition in Socio-Technical Systems: Multi-Level Perspective
- E) Critical Theory of Technology

iii. Gender and Technology

How gender influences technologies and the social organization of scientific and technical workspaces---technologies constructed as masculine and feminine—technologies as both ‘liberating’ and ‘limiting’ women---contributions of Cynthia Cockburn & Donna Haraway

iv. Public Engagement with Technology

Contributions of Trench, Lewenstein, Jasanoff & Vishvanathan---governance and ethical issues in the context of emerging technologies-----constructing risk....role of State, civil society organizations and industry---regulatory dilemmas of transnational capitalism and influence of local contexts—democratisation and ‘up-stream’ public engagement with technology

Essential Readings

- Collins, Harry and Pinch, Trevor 1993. *The Golem: What Everyone should Know about Science*. Cambridge: Cambridge University Press.
- Hess, David J. 1995. *Science and Technology in a Multicultural World: The Cultural Politics of Facts and Artefacts*. New York: Columbia Press.
- Hess, David J. 1997. *Science Studies: An Advanced Introduction*. New York: New York University Press.
- Jasanoff, Sheila et al. (eds.). 1995. *Handbook of Science and Technology Studies*. Thousand Oaks, CA: Sage Publications.
- MacKenzie, Donald and Judy Wajcman 1999 (eds.). *The Social Shaping of Technology*, 2nd edition, Open University Press.
- Sismondo, Sergio 2010. *An Introduction to Science and Technology Studies* (2nd edition). Chichester: Wiley-Blackwell.

Recommended Readings

- Anne Fausto-Sterling. 2002. "Gender, Race and Nation: The Comparative Anatomy of 'Hottentot' Women in Europe, 1815–17. In Kimberly Wallace-Sanders (ed.). *Skin Deep, Spirit Strong: The Black Female Body in American Culture*. Ann Arbor: The University of Michigan Press, pp. 66–95.
- Bijker, Wiebe E. 1997. *Of Bicycles, Bakelites and Bulbs: Toward a Theory of Sociotechnical Change*. Cambridge, MA:MIT Press.
- Bijker, Wiebe E. et al. 1989. *The Social Construction of Technological Systems*. Cambridge, MA: MIT Press.
- Bloor, David 1976. *Knowledge and Social Imagery*, second edition, London: Routledge and Kegan Paul.
- Bourdieu, Pierre. 2004. *Science of Science and Reflexivity*. Cambridge: Polity Press.
- Bucchi, Massimiano. 1996. "When Scientists Turn to the Public: Alternative Routes in Science Communication." *Public Understanding of Science* 05: 375–394.
- Callon, Michael. 1986. "Some Elements of a Sociology of Translation: Domestication of the Scalops and the Fisherman of St. Brieuc Bay", in Law, John 1986. *Power, Action and Belief: A New Sociology of Knowledge?* London: Routledge and Kegan Paul. Pp. 196–229.
- Collins, H.M. 2001. "Tacit Knowledge, Trust and the Q of Sapphire", *Social Studies of Science* 31(1): 71–85.
- Cutcliffe, Stephen H. 1989." The Emergence of STS as an Academic Field", *Research in Philosophy and Technology* 9: 287–31.
- Erikowitz, Henry. 1990. "The Capitalisation of Knowledge", *Theory, Culture and Society* 19: 107–21.
- Fausto-Sterling, Anne 1989. "Life in the XY Corral", *Women's Studies International Forum* 12/3: 319–31.
- Feenberg, Andrew. 2005. "Critical Theory of Technology: An Overview." *Tailoring Biotechnologies* 1(1): 47-64.
- Galison, Peter and Stump, David (eds.). 1996. *The Disunity of Science: Boundaries, Contexts, and Power*. Stanford, CA: Stanford University Press.
- Geels, F. W. (2004). "From Sectorial Systems of Innovation to Socio-technical Systems: Insights about Dynamics and Change from Sociology and Institutional Theory." *Research Policy*: 33:897-920.
- Gibbons, Michael et al. 1994. *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. London: Sage.
- Gieryn, Thomas F. 1983. "Boundary-work and the Demarcation of Science from Non-science: Strains and Interests in Professional Ideologies of Scientists", *American Sociological Review* 48: 781–95.
- Haraway, Donna 1989. *Primate Visions: Gender, Race and Nature in the World of Modern Science*. New York: Routledge and Kegan Paul.
- Harding, Sandra 1986. *The Science Question in Feminism*. Ithaca, NY: Cornell University Press.
- Hilgartner, Stephen. 1990. "The Dominant View of Popularization: Conceptual Problems, Political Uses." *Social Studies of Science* 20/3, August: 519–39.
- Irwin, Alan 1995. *Citizen Science*. London: Routledge.
- Joerges, B. 1999. "Do Politics Have Artefacts," *Social Studies of Science* 29, pp. 411-431.
- Keller, Evelyn Fox 1985. *Reflections on Gender and Science*. New Haven, CT: Yale University Press.

- Keller, Evelyn Fox and Longino, Helen E. (eds.). 1996. *Feminism and Science*. Oxford: Oxford University Press.
- Knorr Cetina, Karin 1981. *The Manufacture of Knowledge: An Essay on the Constructivist and Contextual Nature of Science*. Oxford: Pergamon Press.
- Kuhn, Thomas S. 1970 (1962). *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press (revised second edition).
- Latour, B. 1992. "Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts," in W.E. Bijker and J. Law, eds., *Shaping Technology/Building Society*. Cambridge, MA: MIT Press, pp. 225-258.
- Latour, B. 2005. *Reassembling the Social: An Introduction to Actor–Network Theory*, Oxford, New York: Oxford University Press.
- Latour, Bruno and Woolgar, Steve. 1986 (1979). *Laboratory Life: The Construction of Scientific facts*. Princeton, NJ: Princeton University Press.
- Latour, Bruno. 1987. *Science in Action: How to Follow Scientists and Engineers through Society*. Cambridge, MA: Harvard University Press.
- Latour, Bruno. 1988. *The Pasteurisation of France*. Cambridge, MA: Harvard University Press.
- Law, John and John Hassard 1999 (eds). *Actor Network Theory and After*. Blackwell Publishers.
- Lewenstein, Bruce 1995. "From Fax to Facts: Communication in the Cold Fusion Saga", *Social Studies of Science* 25(3): 403–436.
- Lynch, Michael 1985. *Arts and Artefact in Laboratory Science: A Study of Shop Work and Shop Talk in a Research Laboratory*. London: Routledge and Kegan Paul.
- Martin, Emily 1991. "The Egg and the Sperm: How Science has Constructed a Romance based on Stereotypical Male-Female Roles", *Signs* 16 (3): 485–501.
- Merchant, Carolyn 1980. *The Death of Nature: Women, Ecology and the Scientific Revolution*. New York: Harper and Row.
- Merton, Robert 1973. *The Sociology of Science: Theoretical and Empirical Investigations*. Chicago: University of Chicago Press.
- Merton, Robert K. 1968. "The Matthew Effect in Science", *Science*, New Series, 159 (3810): 56–63.
- Nandy, Ashis 1988. *Science, Hegemony and Violence: A Requiem for Modernity*. New Delhi: Oxford University Press.
- Nanda, Meera 2002. *Breaking the Spell of Dharma and Other Essays*. New Delhi: Three Essays Collective.
- Nanda, Meera 2004. *Prophets Facing Backward: Postmodern Critiques of Science and the Hindu Nationalism in India*. New Brunswick: Rutgers University Press.
- Pickering, Andrew (eds.). 1992. *Science as Practice and Culture*. Chicago: Chicago University Press.
- Polanyi, Michael 1967. *The Tacit Dimension*. London: Routledge and Kegan Paul.
- Price, Derek J. de Sola 1963. *Little Science, Big Science*. New York: Columbia University Press.
- Rose, Hilary and Rose, Steven. 1969. *Science and Society*. Harmondsworth: Penguin.
- Schiebinger, Londa. 1999. *Has Feminism Changed Science?* Cambridge and London: Harvard University Press.
- Shinn, Terry, and Richard Whitley, ed. 1985. *Expository Science: Forms and Functions of Popularisation*. Vol. Edited. Dordrecht, Boston and Lancaster: D. Reidel Publishing Company.
- Shiva, Vandana 1989. *Staying Alive: Women, Ecology and Development*. London: Zed Publishers.

- Visvanathan, S. 1997. *A Carnival for Science*. Delhi: Oxford University Press, 1997, Ch. 2 (“On the Annals of the Laboratory State”), pp. 15-47.
- Webster, Andrew 1992. *Science, Technology and Society: New Directions*. Rutgers University Press.
- Weinberg, Alvin. 1966. “Can Technology Replace Social Engineering?” *TATF* 23-30.
- Winner, L. 1993. “Upon Opening the Black Box and Finding It Empty: Social Constructivism and the Philosophy of Technology,” *Science, Technology and Human Values* 18: 362-378.
- Woolgar, S. and G. Cooper, 1999. “Do Artefacts have Ambivalence,” *Social Studies of Science* 29, pp. 433-447.
- Woolgar, Steve. 1988. *Science, the very Idea*. London: Tavistock.
- Wynne, Brian 1996. “Misunderstood Misunderstandings: Social Identities and Public Uptake of Science”, *Public Understanding of Science* 1(3): 281–304.
- Zilzel, Edgar. 1942. “The Sociological Roots of Science”, *American Journal of Sociology* 47: 544–62. Republished in *Social Studies of Science* 30/6, December (2000): 935–49.
- Ziman, John 2000. *Real Science*. Cambridge: Cambridge University Press.

INNOVATION AND SOCIO-ECONOMIC CHANGE

Semester I/ Paper 3

(Credits: 03)

Course Objective

The primary objective of the course is to understand the meaning of innovation and its relevance for the development of the society. It also aims to critically analyse the understanding of innovations from various perspectives and looks into various nuances of innovations. The philosophical bases of innovation and empirical cases discussed in the field of innovation studies are other core areas of understanding.

Course Description

This course intends to cover the changing understanding of innovation and current debates in the field of innovation studies. What are the philosophical bases, how it changed from a derogatory word in ancient and medieval times to a buzzword in the modern times. How scholars have shaped the field of innovation studies and different models have been discussed to understand the process of innovation is another dimension to look into this course. Theoretical sections will cover key definitions, key concepts related to innovations, different types of innovations and models of innovation. The empirical section will focus on formal and informal sector innovations and try to understand the dynamics of both the sectors.

Mode of Evaluation

Term Papers, book and article reviews and assignments in connection with the modules (Weightage: 50%) along with an End Semester examination (Weightage: 50%). 85 % of attendance is required. Participation in class room discussions and activities is mandatory.

Instruction Method

Lecture-cum Seminar and Field Visits (Walkshops)

1. **Conceptualising Innovation:** why innovation? what is the meaning and nuances of innovation? There is no one single definition of innovation and scholars have widened the understanding of innovation over a period. This unit attempts to explore the origin of the term innovation, its nuances and characteristics of innovations.
 - a. This will further explore typologies such as major and minor innovation and radical and incremental innovations.
 - b. Since there is no single definition of innovation, scholars shifted their focus on understanding the process of innovation and proposed different models. So, what are different models and how they look into the process of innovation is another component to look for in this unit.

- c. Diffusion of innovation is also another major dimension which we will cover in this unit. Measuring innovations. And
 - a. Measuring innovation is another important theoretical domain and we cover the areas of patent, R&D expenditure, citation index, publications, and other indicators
2. **Towards the Systemic Understanding of Innovation:** The second unit focuses on current theoretical debate in the field of innovation studies and system of innovation is one of the dominant paradigms. How system theory is conceptualised, what are the pros and cons of system theory of innovations, what components of innovations are and what different systems of innovations are. Advantages and Disadvantages of firm centric model of innovation, innovation system approaches: national system of innovation, sectoral system of innovation system and regional innovation system.
 3. **Social-Psychological Theories of Innovation:** What are the bases of innovation? Whether everyone is innovative? Why one is innovative and others are not? Such individual level question will be asked in this unit and try to look into individual level motivation to innovate, neurophysiological basis of innovations and social factors which affect innovations.
 4. **Innovation and its impact in the society:** Whether all innovations are good or bad? Who are benefited from these innovations? Is there any difference between formal and informal sector innovations. These questions will be discussed in this unit. We will look into innovation and its role in the development process, what are the policy implications of innovation and some specific cases such as grassroots innovations will be taken up to understand the role of innovations in the society.

Essential Readings

- A. Spanos (2010), *To Every Innovation, Anathema (?) Some Preliminary Thoughts on the Study of Byzantine Innovation*, in *Mysterion, strategike og kainotomia Et festskrift til ære for Jonny Holbek*, Eds. Harald Knudsen, Joyce Falkenberg, Kjell Grønhaug and Åge Garnes, Novus Forlag, Oslo: 51-59.
- A. Spanos (2012), *Was Innovation unwanted in Byzantium?* To be published in: Ingela Nilsson & Paul Stephenson (eds.), *Byzantium Wanted: The Desire and Rejection of an Empire*, Uppsala 2013 [Studia Byzantina Upsaliensia, vol. 15.
- B. Godin (2002), *The Rise of Innovation Surveys: Measuring a Fuzzy Concept*, Project on the History and Sociology of STI Statistics, Paper no. 16.
- B. Godin (2008), *Innovation: the History of a Category*, Working Paper No. 1, Project on the Intellectual History of Innovation, Montreal: INRS. 62 p.
- B. Godin (2009), *National Innovation System (II): Industrialists and the Origins of an Idea*, Working Paper no. 4, Project on the Intellectual History of Innovation, Montreal : INRS.
- B. Godin (2013), *The Unintended Consequences of Innovation Studies*, Paper prepared for a communication presented at "Policy Implications due to Unintended Consequences of Innovation", Special Track at EU-SPRI, Madrid, 10-12 April 2013.
- B. Godin (2014), *The Vocabulary of Innovation: A Lexicon*, Project on the Intellectual History of Innovation, Paper no. 20, Montreal: INRS. 64p. Paper presented at the 2nd CASTI Workshop, Agder, Norway, October 20, 2014.
- B. Godin (2015), *Innovation Contested - The Idea of Innovation Over the Centuries*. London: Routledge, 2015.

- Ben R Martin. (2008). The Evolution of Science Policy and Innovation Studies. SPRU – Science and Technology Policy Research, University of Sussex, and Centre for Advanced Study, Norwegian Academy of Science and Letters August 2008.
- Bhaduri, Saradindu and Hemant Kumar. 2011. Extrinsic and intrinsic motivations to innovate: tracing the motivation of ‘grassroot’ innovators in India. *Mind and Society: Cognitive Studies in Economics and Social Sciences*. 10(1):27-55.
- Carlsson, B. and R. Stankiewicz (1991), On the Nature, Function, and Composition of Technological Systems, *Journal of Evolutionary Economics* 1 93-118;
- Chesbrough, H.; Vanhaverbeke, W.; West, J., eds. (15 April 2008). *Open Innovation: Researching a New Paradigm*. Oxford University Press.
- Edquist, C. and B. Johnson (1997), Institutions and organizations in systems of innovation, in: C. Edquist (Eds.), *Systems of Innovation - Technologies, Institutions and Organizations* *Institutions and organizations in systems of innovation*, Pinter, London.
- Egil Kallerud (2011) *Goals conflict and goal alignment in science, technology and innovation policy discourse*, NIFU Nordic Institute for Studies in Innovation, Research and Education. Norway.
- Fagerberg, Jan, David C. Mowery, and Richard R. Nelson (2006). *Oxford Handbook of Innovation*. OUP.
- Freeman, C. (1988) ‘Japan: A new national innovation system?’, in G. Dosi, C. Freeman, R. Nelson, G. Silverberg and L. Soete (eds.) *Technology and economy theory*, London: Pinter.
- Freeman, C. (1995) “The National System of Innovation” in Historical Perspective. *Cambridge Journal of Economics*.
- Garcia, R. and Calantone, R. (2002). A critical look at technological innovation typology and innovativeness terminology: a literature review. *The Journal of Product Innovation Management*. 19: 110-132.
- Geels, F.W. (2005). *Technological transitions and system innovations*. Cheltenham: Edward Elgar Publishing.
- Heyne, P., Boettke, P. J., and Prychitko, D. L. (2010). *The Economic Way of Thinking*. Prentice Hall, 12th ed.
- Hicks, D. and S. KATZ (1996), Systemic Bibliometric Indicators for the Knowledge-Based Economy, paper presented at the OECD Workshop on New Indicators for the Knowledge-based Economy, Paris, 19-21 June.
- J.P. Lane and B. Godin (2012), Is America's Science, Technology, and Innovation Policy Open for Business? in *Science Progress*, June :scienceprogress.org/.../
- Kumar, Hemant and Saradindu Bhaduri. 2014. *Jugaad to grassroot innovations: understanding the landscape of the informal sector innovations in India*. *African Journal of Science, Technology, Innovation and Development*. 6(1):13-22. Doi: 10.1080/20421338.2014.895481.
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Course No: STI 651

Research Methodology-II (Technology Futures Analysis)

Semester II/ Paper I

(Credits: 02)

Course Objective

In the previous semester we looked into qualitative research methods. In this semester the focus is on developing understanding of quantitative tools and techniques of research with special reference to the domain of future studies in science policy.

Course Description

This course intends to cover historical context of quantitative methods and some specific tools and techniques used in the field of science policy studies. Technology Future Analysis (TFA) is one of the major areas of technological analysis and has emerged in the last few decades. We also intend to introduce statistical concepts used to measure social and scientific phenomenon. The exercises will focus on use of statistical software packages such as SPSS, STATA, and Social Network Analysis.

Mode of Evaluation

Term Papers, book and article reviews and assignments in connection with the modules (Weightage: 50%) along with an End Semester examination (Weightage: 50%). 85 % of attendance is required. Participation in class room discussions and activities is mandatory.

Instruction Method

Lecture-cum seminar and field work

1. **Introduction:** What are the major Concepts, Approaches, Historical Perspective on Technology Assessment and Forecasting, Technological Foresight, Comparison of TATF, Foresight and TFA, Role of TFA, Relevance of TFA to the Developing Countries, Ethical Issues and Overall Socioeconomic TA, Horizon scanning, Innovation foresight.
 - a. **Major Issues:** Temporal and Sectoral Dimensions, Ideological Dimensions, Boundary Conditions and Core Assumption, Validation and Public Participation.
 - b. **TATF Structures in India** and Developed Countries Changing Patterns in Private (Business Planning) and Public Sector Assessment.
 - c. **Major Techniques in Technology Assessment:** Historical Surveys, Cost Benefit Analysis, Input/Output Analysis, System Analysis, Cross Impact, EIA, Risk Analysis, Overall socioeconomic TA.
 - d. **Major Techniques:** Normative and Exploratory Techniques: Delphi, Analogy, Growth Curves, Trend Extrapolation, Analytical Models, Breakthrough Rate, Scenario Writing, Relevance Tree, Morphological Analysis.
2. **Technology Road Mapping:** Typology of Socio-Technical Transitions, Sustaining vs. Disruptive Technologies, Complex Technology Sub-System, Typology of Roadmaps (a) product planning (b) service/capability planning (c) strategic planning; (d) Long-range

planning (e) knowledge asset planning (f) program planning (g) process planning; (h) Integration planning

a. **TRIZ analysis** (*Teoriya Resheniya Izobreatatelskikh Zadatch*): Theory of invention: How inventors invent? Theory of increasing ideality

3. Technology Futures Analysis: Umbrella Concept for Multiple Methods, Multi Actor Context, Participative Approach, Process Management, Negotiation Oriented Approaches, Dialectic Approach

4. Quantitative Research Methods: Introduction to quantitative techniques and fundamentals of quantitative research, Hypothesis development and testing, Data collection methods, Sampling and measurement, Descriptive statistics. Basic SPSS and STATA skills, Review of Statistical Concepts Useful for Causal Inference, Bi-variate analysis, Regression, Correlation, Multivariate analysis. Debating quantitative research techniques.

Readings

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- Linton, J.D. and S.T. Walsh (eds) (2004), "Roadmapping: From Sustainable to Disruptive Technologies", *Technological Forecasting & Social Change*, Vol. 7, No.1–3, pp11–96.
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- Mayo, Louis H. (1977), *Monitoring the Direction and Rate of Social Change Through the Anticipatory Assessment Function*, George Washington University Program of Policy Studies in Science and Technology, Washington, D.C..
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Important Journals

1. *Technology Forecasting and Social Change*
2. *International Journal for foresight and Innovation Policy*

Important links

1. TIFAC

<http://www.tifac.org.in/>

2. Policy Research in Engineering, Science and Technology (PREST)

<http://www.mbs.ac.uk/research/centres/engineeringpolicy>

3. Science Policy Research Unit, Sussex

<http://www.sussex.ac.uk/spru/>

Course No: STI 652

SCIENCE AND TECHNOLOGY IN MODERN INDIA

Semester II/ Paper II

(Credits: 03)

Course objectives

The course intends to provide the students with a deep understanding of multiple dimensions of science and technology in modern India with an emphasis on the debates in social history of science and technology in India. The students will be introduced to the historical evolution of science and technology in the Indian context(s), as well as the historical processes behind the emergence of the national S&T system with unique characteristics and cultural dynamics.

Course description

The course introduces the colonial, post-independent and post-liberalisation/globalisation phases of Indian science, with a detailed discussion on different historiographical points of view on the processes involved.

Mode of Evaluation

Term Papers, book and article reviews and assignments in connection with the modules (Weightage: 50%) along with an End Semester examination (Weightage: 50%). 85 % of attendance is required. Participation in class room discussions and activities is mandatory.

Method of Instruction

Lecture/seminars/ tutorials

UNITS

1. Origin and Development of Modern Science

How did modern science emerge? Was Europe the site of its origin and development?

Enlightenment, Capitalism and Colonisation-scientific and industrial revolutions in Europe-inventing the Greek past -Islamic scholars' contributions-Needham's ecumenical view-

Europe as the locus: Why not India or China?-circulation of knowledge-multicultural roots of science

2. Science in the Colony

Basalla's three stage model of diffusion of science and its critiques-pre-colonial science in India-Portuguese and Dutch interventions-*Early phase* of British colonialism- the great surveys- infrastructure development- telegraph and railways-*Second phase*: universities and colleges-Missionary initiatives-*Third phase*: development of industrial research-National Planning Committee (1938)-Bombay Plan (1944)-AV Hill report (1944)-Establishment of CSIR: 1942-R&D Laboratories-Indian Institute of Technology (IITs)-domestication of

science and the colonial intelligentsia- societies and organisations for popularisation of science in vernacular languages-origin and development of Indian scientific community

3. Development of Science & Technology 1920-1991

- a. Science and Scientists: a social history of M.N. Saha, S.S. Bhatnagar, C.V. Raman, and H.J. Bhabha,
- b. Science, Scientists and Politics: Saha, Bhatnagar, and Bhabha and their role in establishment of various scientific institutions, Nehru and Scientific Temper.
- c. Science and Technology in Independent India 1941-1991: Establishment of Science and Technology Ministry, Formation of Ministry of Natural Resources & Scientific Research Cabinet in 1947. Establishment of various research institutes such as CSIR, BARC, AIIMS, ICAR, IITs.
- d. Planning for Science, Technology and Economic development: Nehru-Mahalanobis Model: The Five year plans.
- e. Development of science and technology in specific areas: space technology, nuclear technology, bio-technology and renewable energy.
- f. Science and Technology Policy documents: 1958, 1983, 2003, and 2013.
- g. Industrial Policy documents since pre-independence period.
- h. Science and Society in independent India: what citizens understand by science? Was science uncontested? Science Movements, Peoples' Science Movement (PSM), Khadi Village Industries, CAPART, Appropriate Technology Movement, Grassroot Innovation.

4. S&T after Economic Reforms-Globalization, Liberalization Privatization (Post-1991 Phase)

- a. Science, Technology and Innovation In India: Trends in Post-Liberalization Phase/ Impact of Globalization, Liberalization and Privatization ---Historical Overview of Major Developments (1990-2014)---Features and Impact of various Five Year Plans ---Impact of Liberalization on R&D and non-R&D based innovations in Indian enterprises---FDI and its impact---Emergence and implications of Public Private partnerships in post-Liberalization phase---S&T strategies for poverty alleviation and rural development: A Critical Assessment--Trends in S&T output in Post-Liberalization period
- b. S&T and Democratization---Discourses and Critique: Shiv Vishvanathan, Ashis Nandy, Claude Alvares, Vandana Shiva, Meera Nanda, Itty Abraham ---Civil Society initiatives in S&T issues in India---S&T controversies in India in post-Liberalization phase
- c. S&T Policy in India in the post-1990s Phase: An Assessment---Science and Technology Policy 2003---Science, Technology and Innovation Policy 2013

Essential Readings

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- Habib, S. Irfan and Raina, Dhruv 2007 (eds.). *Social history of Science in Colonial India*. New Delhi: Oxford University Press.
- Kumar, Deepak. 1995 (2011). *Science and the Raj: A Study of British India*. New Delhi: Oxford University Press.

Recommended Readings

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- Hessen, Prof. B. 1931 (1971). "The Social and Economic Roots of Newton's 'Principia'", in *Science at the Cross Roads: Papers presented to the International Congress of the History of Science and Technology held in London from June 29th to July 3rd, 1931 by the Delegates of the USSR*. London: frank Cass and Co Ltd., pp. 151–212.

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OPTIONAL COURSES

Course No: STI 671

INTELLECTUAL PROPERTY RIGHTS AND DEVELOPMENT

Semester II/ Optional Paper

(Credits: 03)

Course Objective

The course is designed to introduce fundamental aspects of Intellectual property Rights (IPRs) to scholars who are engaged in the research area of science technology and innovation policy. The course introduces all aspects of the IPRs. It also includes case studies to demonstrate the application of the concepts in Science, Technology and innovation policy studies. The course is designed for raising awareness of a multidisciplinary audience.

Course Description

A renewed awakening of the role of intellectual property (IPRs) in the countries of the various regions of the world in general and India in particular has led more recently to the adoption or revision of national legislation on Intellectual Property Rights (IPRs) as well as to the establishment or modernization of Government structures that administer such legislation and influence development. The changing regime of IPRs has become one of the crucial issues in the contemporary relations among nations. The New IPRs regime that has come into being has an important role to play in the domain of New Generic Technologies (NGT), Information and Communication Technology (ICT), Biotechnology (BT) and Nanotechnology (NT).

Mode of Evaluation

Book/Article reviews, Term Paper and assignments (Weightage: 50%). There will also be an End Semester examination (Weightage: 50%). 85 % of attendance is required. Participation in class room discussions and activities is mandatory.

Method of Instruction

Lecture/Seminars/Presentation Classroom Exercise/Tutorials

UNITS

1. Knowledge, Innovation and Intellectual Property Rights: An Introduction

- a. Knowledge – characteristics and role in economic growth, Tacit and codified knowledge, Knowledge as public good and ‘market failure’, Market for knowledge, Incentives for creation of new knowledge, Appropriation of knowledge: knowledge monopoly and its consequences;
- b. Pre-IPR system of protection: Secrecy/Trade guilds/Cartels
- c. IPR: Consequentialist, right based justification and economic justification
- d. Basic forms of IPRs: Patent, copyright, trademark, industrial design

2. Evolution of IP Statutes – Origin and Internationalization

- a. First IP Statutes: English Statute of Monopolies (1624); United States Patent Act (1836), German Patent Act (1877), Copyright law of Italy, English Statute of Anne (1710)
- b. International organizations and Treaties (pre- TRIPs era): Paris Convention, Berne Convention, Rome convention, IPIC Treaty, Budapest Treaty. CBD, UPOV convention. WIPO, GATT, FAO, UNCTAD
- c. WTO Framework and the TRIPs Agreement, Unification of IP rights, Extension of protect able subject matter, New forms of IPRs, Scope of Sui-generis systems, Role of Patent Cooperation Treaty

3. . IPR in India: Emerging Technology and Legislations

- a. Science of Biotechnology, Genetic engineering and ICT.
- b. Patentability criteria in Biotechnology/ICT inventions.
- c. Distinction between discovery and innovation in Biotechnology.
- d. Reexamining the standards of novelty and non-obviousness, reproducibility in the contexts of biotechnology/ICT.
- e. Inter-country differences in patenting of life forms/ICT
- f. The Patent Act of India 1911 and the Indian Patent Act of 1970.
- g. IP rights in India and progressive harmonization with international standards;
- h. Patent Amendment Act (2005)
- i. Some case studies giving examples of patents and technology transfer, access and affordability of medicines in India.
- j. Deliberations of the National Working Group on Patent laws

4. Debates on IPR and Development

- a. IPRs and technology transfer
- b. IPRs vis-à-vis access & affordability of medicines
- c. Bayh-Dole Act and issues of academic entrepreneurship, advancement of science and commercialization of university research
- d. Traditional knowledge, IPR and Benefit sharing, Indigenous knowledge and its appropriation IPR & Traditional Medicine, Private vis-à-vis community based ownership, Biopiracy, Breeders vis-à-vis Farmers rights
- e. Life form patenting (technical and ethical issues)

Essential Readings:

- Asian Biotechnology and Development Review*. 7(2). (Complete Issue)
- Biotechnology and IPR Regime: In the context of India and Developing countries (2005).
- Choudhuri, S. (2003). *The WTO and India's Pharmaceutical Industry*. Oxford University Press: New Delhi.
- Commission on Intellectual Property Rights, Innovation and Public Health (CIPRH): Publications & Study Materials* (<http://www.who.int/intellectualproperty/en/>)
- Correa, Carlos M. and Abdulqawi A. Yusuf (eds) (1998). *Intellectual Property and International Trade: The Trade Agreement*. Kluwer Law International, London.
- Cottier, Thomas and Mavroidis, C. Petros (2003). *Intellectual Property: Trade, Competition, and Sustainable Development*. World Trade Forum, Volume 3. The University of Michigan Press.
- Dasgupta, B. (1999). Patent lies and latent danger: A study of the political economy of patent in India. *Economic and Political Weekly*., April 17-24, 979-993.
- Desai, P.N. (2007). *Traditional Knowledge and Intellectual Property Protection: Past and Future*. Science and Public Policy, 185-197.

Recommended Readings

- Evenson, E. R. and Westphal, J. L. (1995). *Technological Change and Technology Strategy* In: Handbook of Development Economics (Jere Behrman and T.N. Srinivasan). Elsevier.
- Ginarte, J. C. and Park, W.G. (1997). *Determination of Patent Rights: A Cross National Study*. Research Policy, Vo. 26.
- Hellar, A. Michael and Eisenberg, S. Rebecca (1998). *Can Patents Deter Innovation? The Anticommons in Biomedical Research*. Science, Vol 280.
- Kamil Idris *Intellectual Property: A Powerful Tool for Economic Growth*. World Intellectual Property Organisation.
- Kumar, Nagesh (2003). *Intellectual Property Rights, Technology and Economic Development: Experiences of Asian Countries*. Economic and Political Weekly, January 18.
- Lanjouw, J. O. (1998). *The Introduction of Pharmaceutical Product Patents in India: Heartless Exploitation of the Poor and the Suffering?*. NBER Working Paper Series No 6366, National Bureau of Economic Research, January.
- Levin, R., Klevorick, A., Nelson, R. and Winter, S. (1987). *Appropriating the Returns from Industrial Research and Development*. Brookings Papers on Economic Activity, Vol. 3.
- Mansfield, Edwin (1986). *Patents and Innovation: An Empirical Study*. Management Science, Vol. 32 No. 2, February.
- Mashelker, R.A. (2002). *Intellectual Property Rights and the Third World*. Journal of Intellectual Property Rights. Vol. 7, pp. 308-323.
- Maskus, Keith (2000). *Intellectual Property Rights in the Global Economy*. Institute of International Economics. Washington DC.
- Mazzoleni, R. and Nelson, R.R. (1998). *The Benefits and Costs of Strong Patent Protection: A Contribution to the Current Debate*. Research Policy 27 (1998) 273-284.
- Mowery, D.D. and Sampat. B.N. (2001) *Patenting and Licensing University Inventions: Lessons from the history of the research corporation*. Oxford University Press 2001.
- NAPAG (1995). *Intellectual Property and the Academic Community*. National Academics Policy Advisory Group. London, UK
- National Working Group on Patent Laws. Papers and Reports. CSSP Library
- Nuffield(2002). *The Ethics of Patenting DNA*. Nuffield Council of Bioethics, London, UK. Occasional Paper Series of Trade Related Agenda, Development and Equity (T.R.A.D.E.) The South Centre.
- Ramanna, A (2005). Bt Cotton and India's Policy on IPRs, *Asian Biotechnology and Development Review*. 7(2), pp. 43-51
- Rao, C.N. (2002). Patents for Biotechnology Inventions in TRIPs. *Economic and Political Weekly*. 2126-2129.
- Royal Society (2003). *Keeping Science Open: The Effects of Intellectual Policy on the Conduct of Science*. Prepared by the Royal Society Working Group on Intellectual Property, London: Royal Society, accessed from www.royalsoc.ac.uk Wiley & Sons Inc.
- Smith, G and Parr, R.L. (1989). *Valuation of Intangible Assets*. New York: John Wiley & Sons Inc.
- Stephen, A. Merrill, Richard, C. Levine and Mark B. Myes (2004). *A Patent System for the 21st Century*. The National Academic Press, Washington, DC.
- Stiglitz, J (2006). Making Globalisation Work Penguin Books Ltd.: England. page 103-132.
- Swaminathan, M.S (2002). *The Protection of Plant Varieties and Farmers' Rights Act: From Legislation to Implementation*. Journal of Intellectual Property Rights. 7, pp. 324-329.
- Vasudeva, P.K. (2000). Patenting biotech products: Complex issues. *Economic and Political Weekly*. 3726- 3729.

- Vivien Irish (2000). *How to Read a Patent Specification*. Engineering Management Journal. April, pp. 71-73.
- Watal, Jayshree (2001). *Intellectual Property Rights in the WTO and Developing Countries*. Oxford University Press: New Delhi.
- Wesley, M. Cohen and Stephen, A. Merrill (2004). *Patents in the Knowledge Based Economy*. The National Academic Press, Washington, DC.

Course No: STI 672

Title of the Course: Science and Technology Policy Analysis

Course No: SSD-655

Course Credits: 3

Winter Semester

Course Objective: Science and Technology Policy serves as an important agent of social, economic and political change. The present course would attempt to provide students with insights into the nature of S&T policy and its historical context; its organizational architecture in terms of how S&T is funded and performed by various actors; the changing institutional context of S&T policies; the role of civil society, industry and the State in moulding S&T policies and the ways in which S&T policies frame and mould the governance and regulation of emerging technologies in a global context. Additionally, the course would also enable students to develop a critical insight into S&T policies in various sectors, with particular reference to India. Cross-national comparison of S&T policies in various sectors would also be taken up in this regard. The course primarily aims at equipping students with a theoretical and empirical understanding of the changing nature and dynamics of S&T policy in the Indian context.

Method of Instruction: Lectures/ Seminar/ Tutorials

Teaching and Contact Hours: Four hours per week (including one tutorial)

Method of Evaluation: Term paper, seminar presentations and book reviews. Students will also be expected to submit case studies in sectors of their choice (Weightage: 50%). End Semester examination (Weightage: 50%).

Course Modules:

1. S&T Policy: Historical Evolution, Perspectives & Organizational Architecture

- A) Historical Evolution and changing agendas in S&T Policy
- B) S&T Policy Cultures
- C) Phases in S&T in India
- D) Funding of S&T & Key Actors in R&D and Policy Making
- E) Role of S&T Indicators in Policy Making

2. Changing Institutional Framework of S&T Policy & its Governance

- A) Blurring of traditional distinction between Science & Technology--Impact on Transfer of Technology
- B) Academic-Industry Collaborations
- C) Shift from Mode 1 to Mode 2 form of Knowledge Production--Triple Helix model

3. S&T Controversies, Expertise and Public Policy

- A) S&T Policy & Co-Production of Knowledge
- C) Role of Civil Society, Industry and State
- C) Risk-based regulation and 'Responsible Governance'

4. Globalization and S&T Policy

- A) Changing North-South relations and the Emergence of Transition Economies
- B) Intellectual Property Rights and Changing Policy Regimes
- C) Cross-National comparison of S&T policies in various sectors

D) S&T Policy and Emerging Technologies

Readings

- Adboye, T. and Clark, N. (1997) 'Methodological Issues in Science and Technology Policy Research: Technological Capability', *Science, Technology and Society*, 2(1): 73-98.
- Anne Stein, Josephine (2002). Globalization, Science, Technology & Policy. *Science and Public Policy*, Volume 29, No 6: 402-408
- Archibugi, Daniel & Kim Bizzari. (2004). Committing to Vaccine R&D- A Global Science Policy Priority. *Research Policy*. 33:1657-1671
- Asheulova, Nadia, Binay Kumar Pattnaik, Eduard Kolchinsky & Gregory Sandstrom. (Eds). 2010. *Liberalizing Research in Science and Technology: Studies in Science Policy*. Saint-Petersburg: Politechnika, ISBN 978-5-904031-76-3
- Bastos, Maria-Ines (1996), "Science and Technology Policies in Developing Countries: A Political Analysis of Latin American Practice and Prospects", *Science, Technology and Society*, 1(2), July-December: 225-247.
- Beasley, Lisa. (2003). Science Policy in Transition. Are Governments poised to take full advantage of an institution in transition. *Research Policy*. 32:1519-1531
- Chaturvedi, Sachin and Krishna, Ravi Srinivas. (2012). Science and Technology Indicators: New Challenges. *Current Science*, Volume 102: No.12.
- Elzinga, A and Jamison, A (1995), Changing Policy Agendas in Science and Technology, in Jasanoff, S *et al* (eds.) *Handbook of Science & Technology Studies* (London: Sage)
- Elzinga, Aant. (2012). Features of the Current Science Policy Regime: Viewed in Historical Perspective. *Science and Public Policy*. Volume 39. Issue 4.
- Etzkowitz, Henry, Webster, Andrew, Gebhardt, Christiane and Branca, Regina. (2000). The Future of the University and the University of the Future: Evolution of the Ivory Tower to Entrepreneurial Paradigm. *Research Policy* 29:313-30.
- Evenson and G. Ranis (eds.) 1990. *Science and Technology: Lessons for Development Policy*. Intermediate Technology Publications, London, pp.157-178
- Fealing, Kaye, Julia Lane & Stephanie Shipp. (2011). *The Science of Science Policy*. Stanford University Press
- Gibbons, M *et al* (1994), *The New Production of Knowledge: The Dynamics of Research in Contemporary Societies* (Sage)
- Gummett, P (1991), The Evolution of Science and Technology Policy: A UK Perspective, *Science and Public Policy* Vol.18 No.1 pp31-37
- Guston, David and Sarewitz, Daniel. (2006). Eds. *Shaping Science and Technology Policy: The Next Generation of Research*. University of Wisconsin Press.
- Henriques, Luisa & Phillipe Laredo. (2012). Policy making in Science Policy: The 'OECD' model Unveiled. *Research Policy*. <http://dx.doi.org/10.1016/j.respol.2012.09.004>
- Hughes, Kirsty (1988), "The Interpretation and Measurement of R & D Intensity". *Research Policy*, 17(5), October, pp. 301-307.
- Irwin, Alan (2001). "Constructing the Scientific Citizen: Science and Democracy in the Biosciences". *Public Understanding of Science*, 10/1:1-18.
- Jasanoff, Sheila (1997) (ed.), *Comparative Science and Technology Policy*. Edward Elgar Publishing Limited, Cheltenham/Lyme.
- Krishna, V.V. (1997). "A Portrait of the Scientific Community in India: Historical Growth and Contemporary Problems", in Gaillard, Jacques *et al.* (ed.). *Scientific Communities in the Developing World*. New Delhi: Sage Publishers, pp. 236-80.
- Krishna, VV (2001). Changing Policy Cultures, Phases and Trends in S&T Policy in India. *Science and Public Policy*. Volume 28, No 3, pp 179-194
- Martin, Brian and Richards, Evelleen (1995). "Scientific Knowledge, Controversy, and Public Decision Making". In Jasanoff, Sheila *et al.* (eds.) *Handbook of Science and Technology Studies*. London: Sage, pp. 506-26

- Michaelson, Evans S. (2008). Globalization at the nano frontier: The future of nanotechnology policy in the United States, China, and India. *Technology in Society*. 30:405-410
- Naidu, P.K. (1967) "Spotlight on CSIR (Science Policy in Crisis II)", *Mainstream* 5(36), May 6, pp. 31–32.
- Naidu, P.K. (1967), "Science Policy and its Implementation (Crisis in Science Policy I)", *Mainstream* 5(35), April, pp.29-30, 38.
- Noble, David, F. (1977), *America by Design: Science, Technology, and the Rise of Corporate Capitalism*. AA Knopf, New York.
- Nowotny, Helga. (2007). How Many Policy Rooms are there? Evidence-Based and Other Kinds of Science Policies. *Science, Technology and Human Values*. Volume 32, No 4: 479-490
- Parthasarathi, Ashok (1969). "Appearance and Reality in Indian Science Policy". *Nature* 221(5184), March 8, pp. 909-911.
- Parthasarathi, Ashok (1972). *Framework and Format for Sectoral S & T Plans: A Control Document prepared for the National Committee on S & T (NCST)*, Government of India Special Assistant for S & T to Prime Minister, New Delhi, March
- Rahman A. and K.D. Sharma (eds) (1974), *Science Policy Studies*. Somaiya Publications Pvt. Ltd., New Delhi and Centre for Studies in Science Policy, Jawaharlal Nehru University.
- Raina, R & et al. (2006), The Soil Sciences in India: Policy Lessons for Agricultural Innovation. *Research Policy*. Volume 13:695-714
- Rangarao, B.V. (1976), "Evolution of Apex Science Policy Body in India". *National Herald*, March 3 and April 1, p.5.
- Ranis, G. (1990), 'Science and Technology Policy: Lessons from Japan and the East Asian NICs', in R.E. Evenson and G. Ranis (eds.) *Science and Technology: Lessons for Development Policy*. Intermediate Technology Publications, London, pp.157-178.
- Rath, Amitav. (1990). Science, Technology and Policy in the Periphery: A Perspective from the Centre. *World Development*. Volume 18, No.29:1418-1423
- Reddy, PS & P. Balachandra. (2003). Integrated Energy-Environment Policy Analysis: A case study of India. *Utilities Policy*, 11:59-73
- Rip, Arie (2003). "Constructing Expertise: In a Third Wave of Science Studies?" *Social Studies of Science* 33(3), June: 419–434
- Sagar, Ambuj. (2002). India's Energy and Energy-R&D Landscape. Report of the Energy Technology Innovation Project. Belfer Center for Science and International Affairs. John F. Kennedy School of Government. Harvard University
- Scoones, Ian. (2006). *Science, Agriculture and the Politics of Policy: The Case of Biotechnology in India*. New Delhi, India: Orient Longman. ISBN 81 250 2944 3
- Turney, J (1997), Science Policy in an Age of Ambivalence, in *What is Science Policy to Science - What is Science to Science Policy?* [HIST SCI [QUARTOS] W 5.1 TUR]
- UNESCO (1979), *An Introduction to Policy Analysis in Science and Technology*. UNESCO, Paris, Science Policy Studies and Documents, No.46.
- UNESCO (1965), *National Science Policies in Countries of South and South-East Asia*, UNESCO, Paris Science Policy Studies and Documents, No.11.
- Wang, Y.F. (1993), *China's Science and Technology Policy: 1949-1989*. Aldershot : Avebury.
- Webster, Andrews. (2007). Crossing Boundaries: Social Science in the Policy Room. *Science, Technology and Human Values*. Volume 32, No 4, pp 458-478
- Weinberg, Alvin M. (1967), *Reflections on Big Science*. The MIT Press, Cambridge, Mass.

Course No: STI 673

SCIENCE COMMUNICATION: APPROACHES AND METHODS

Semester II/ Optional Paper

(Credits: 03)

Course objectives

The course gives an advanced introduction to science communication based on insights from Sociology of Scientific Knowledge (SSK), Public Engagement with Science and Technology (PEST), and Media and Communication Studies. The course proposes that understanding how science is communicated is quintessential to understand the social dynamics of science.

Course Description

The sharing of scientific knowledge within scientific community and its dissemination in the wider society are major concerns for the scientific establishment as well as science policy makers. This has led to the emergence of the field of science communication studies and public understanding of science as two separate fields. However, this approach was challenged in the 1990s and science communication became conceptually situated within the Public Engagement with Science and Technology Studies. This new field of research situates the citizens/public as participating in science in various ways through multiple platforms and actively shaping and democratizing contemporary science. This new 'contextualist model' in PEST Studies that redefines the public by examining actual social situations of science communication is the starting point for the course. The course will enable the students of Science, Technology & Innovation Policy Studies in their individual research projects by providing a wide spectrum of methodological tools and categories. Those who are interested in research problems related to civil society initiatives, social movements, media, communication, cinema, popular culture, education and disaster management also will be benefitted from the course.

Mode of Evaluation

Internal assignments (seminar, term paper, book review etc.) and classroom participation: 50%;
End semester examination: 50%

Method of Instruction

The discussion in the class is organized around the research article assigned for each class. The recommended readings are meant to provide an advanced understanding of the field. Active classroom participation and 85% of attendance is a basic requirement.

UNITS

1. Conceptualizing Science Communication

Linear and multidirectional models of communication-scientific knowledge production and communication-science communication in laboratories-communication during scientific controversies-deficit model-contextualist model- risk societies of the late modernity-the new mode of knowledge production- science in deliberative democracy

2. Public Communication of Science

Science popularization-science textbooks-science communication in classrooms-popular science writing-museums and exhibitions- media and science- journalistic production of science news-science communication during disasters- science in new media-role of the state and civil society

3. Science and Its Public(s)

Public Engagement with Science and Technology-public sphere-multiple publics-the deliberative turn-citizen science-lay and expert knowledge-civic culture of science policy making- experimental models- public controversies over science and technology-science movements-recent shifts in policies-the Indian context

4. Science in Popular Culture

Cultural Studies of Science and Technology-technoscientific culture- Science Fiction Studies-cinema and science-Science in Indian popular culture

Essential Readings

- Irwin, Alan 1995. *Citizen Science: A Study of People, Expertise and Sustainable Development*. London and New York: Routledge.
- Irwin, Alan and Wynne, Brian (eds.) 1996. *Misunderstanding Science? The Public Reconstruction of Science and Technology*. Cambridge: Cambridge University Press.
- Raina, Rajeswari S. (eds.). 2015. *Science, Technology and Development in India: Encountering Values*. Hyderabad: Orient Blackswan.
- Rodder, Simone, Franzen, Martina and Weingart, Peter (eds.) 2012. *The Science's Media Connection—Public Communication and its Repercussions*. Sociology of the Sciences Year Book 28. Dordrecht, Heidelberg, London and New York: Springer.
- Shapin, Steven 1990. "Science and the Public." In *Companion to the History of Modern Science*, eds. R. C. Olby et al., London: Routledge, pp. 990–1007.
- Weingart, Peter 1998. "Science and the Media." *Research Policy*, 27(8), December: 869–79.

Recommended Readings

- Basu, Anustup 2011. "The eternal return and overcoming 'cape fear': science, sensation, superman and Hindu nationalism in recent Hindi cinema", *South Asian History and Culture* 2(4): 557–571.
- Beck, Ulrich 1992. *Risk Society: Towards a New Modernity*. London, New Bury Park and New Delhi: Sage Publications.
- Bensaude-vincent, Bernadette 2001. "A Genealogy of the Increasing Gap between Science and the Public". *Public Understanding of Science*, 10: 99–113.
- Bodmer, Walter 1985. *The Public Understanding of Science*. London: Royal Society.
- Bucchi, Massimiano 1998. *Science and the Media: Alternative Routes in Scientific Communication*. London and New York, Routledge.
- Collins, H.M. 1987. "Certainty and the Public Understanding of Science: Science on Television". *Social Studies of Science*, 17/4, November: 689–713.
- Collins, Harry M. (ed.) 1981. Knowledge and Controversy: Studies in Modern Natural Science [Special Issue]. *Social Studies of Science*, 11/1, February.
- Cooter, Roger and Pumfrey, Stephen 1994. "Separate Spheres and Public Places: Reflections on the History of Science Popularisation and Science in Popular Culture". *History of Science*, 32: 237–67.
- Davenport, Sally and Leitch, Shirley 2005. "Agoras, Ancient and Modern, and a Framework for Science-Society Debate". *Science and Public Policy*, 32(2), April: 137–53.

- Engelhardt, H. Tristram and Caplan, Arthur L. (eds.) 1987. *Scientific Controversies: Case Studies in the Resolution and Closure of Disputes in Science and Technology*. Cambridge: Cambridge University Press.
- Epstein, Steven 1996. *Impure Science: AIDS, Activism, and the Politics of Knowledge*. Berkeley, Los Angeles and London: University of California Press.
- Habermas, Jürgen 1989. *The Structural Transformation of the Public Sphere: An Inquiry into a Category of Bourgeois Society*. Translated by Thomas Burger. UK: Polity Press.
- Hagendijk, R.P. 2004. "The Public Understanding of Science and Public Participation in Regulated Worlds". *Minerva* 42(1): 41–59.
- Hilgartner, Stephen 1990. "The Dominant View of Popularisation: Conceptual Problems, Political Uses". *Social Studies of Science*, 20: 519–39.
- Hilgartner, Stephen 2000. *Science on Stage: Expert Advice as Public Drama*. Stanford: Stanford University Press.
- Irwin, Alan and Michael, Mike 2003. *Science, Social Theory and Public Knowledge*. Maidenhead and Philadelphia: Open University Press.
- Jasanoff, Sheila 2003. "Technologies of Humility: Citizen Participation in Governing Science". *Minerva* 41: 223–244.
- Jasanoff, Sheila 2005. *Designs on Nature: Science and Democracy in Europe and the United States*. Princeton and Oxford: Princeton University Press.
- Leach, Melissa, Scoones, Ian and Wynne, Brian (eds.). 2005. *Science and Citizens: Globalization and the Challenge of Engagement*. London and New York: Zed Books.
- Lewenstein, Bruce V. 1995. "From Fax to Facts: Communication in the Cold Fusion Saga". *Social Studies of Science* 25 (3): 403–36.
- Macdonald, Sharon and Silverstone, Roger 1992. "Science on Display: The Representation of Scientific Controversy in Museum Exhibitions". *Public Understanding of Science*, 1/1: January: 69–87.
- Mc Neil, Maureen (2007) *Feminist Cultural Studies of Science and Technology*, London and New York: Routledge.
- Miller, Steve 2001. "Public Understanding of Science at the Crossroads". *Public Understanding of Science* 10 (1):115–120.
- Mubaraki, Meraj Ahmed (2013) "Mapping the Hindi Horror Genre: Ghosts in the Service of Ideology", *History and Sociology of South Asia* 7(1): 39–60.
- Neidhardt, Friedhelm 1993. "The Public as a Communication System". *Public Understanding of Science*, 2: 339–50.
- Nelkin, D. 1995. *Selling Science: How the Press Covers Science and Technology*. Revised edition. New York: W. H. Freeman and Company.
- Nowotny, H., Scott, P. and Gibbons, M. 2001. *Rethinking Science: Knowledge and the Public in an Age of Uncertainty*. Cambridge: Polity Press.
- Raza, Gauhar, Singh, Surjit and Shukla, Rajesh 2009. "Relative Cultural Distance and Public Understanding of Science", *Science, Technology and Society* 14(2): 269–87.
- Scanlon, Eileen, Whitelegg, Elizabeth, and Yates, Simeon (eds.) 1999. *Communicating Science: Contexts and Channels: Reader 2*. London and New York: Routledge in association with The Open University.
- Shinn, T. and Whitley, R. (eds.) 1985. *Expository Science: Forms and Functions of Popularisation*. Dordrecht, Boston and Lancaster: Reidel.
- State of Science: A Symposium on the Relationship between Science, Knowledge and Democracy, *Seminar* 654, February, 2014.
- Turner, Stephen 2001. "What is the Problem with Experts?" *Social Studies of Sciences*, 31 (1): 123–49.

- Varughese, Shiju Sam. 2011. "Media and Public Controversies over Science: A Case from Kerala, India." *Spontaneous Generations: A Journal for the History and Philosophy of Science*, 5(1), 36–43.
- Varughese, Shiju Sam. 2012. "Where are the Missing Masses? The Quasi-publics and Non-publics of Technoscience." *Minerva: A Review of Science, Learning and Policy*, 50 (2), 239–254.
- Wynne, Brian 2005. "Risk as Globalizing 'Democratic' Discourse? Framing Subjects and Citizens." In *Science and citizens: Globalization and the challenge of engagement*, eds. Melissa Leach, Ian Scoones and Brian Wynne. London and New York: Zed Books, pp. 66–82.
- Zachariah, Mathew and Sooryamoorthy 1994. *Science for Social Revolution? Achievements and Dilemmas of a Development Movement: The Kerala Sastra Sahitya Parishad*. New Delhi: Visthaar Publications.

Course No: STI 674

PHILOSOPHY OF SCIENCE AND TECHNOLOGY

Semester II/ Optional Paper

(Credits: 03)

Course Objective

To learn distinguished characteristics of science and technology, to understand the evolution of science and technology and historical context, and basics of the philosophy of science and technology.

Course Description

This course intends to cover trends in the philosophy of science and technology i.e. to explore and examine what science and technology are, what they do, and how they work in the society. It will also discuss the historical background of the topic both in Western and Indian thoughts to understand how scientific theories evolved over period. It will also explore different scientific disciplines, scientific cultures and their relation to the field of social sciences. Therefore, first we look into the conceptual and philosophical foundation of the science and technology and then the nature and methodology of science.

Mode of Evaluation

Term Papers, book and article reviews and assignments in connection with the modules (Weightage: 50%) along with an End Semester examination (Weightage: 50%). 85 % of attendance is required. Participation in class room discussions and activities is mandatory.

Instruction Method

Lecture-cum Seminar and Field Visits (Walkshops)

Units

1. **Introduction:** What is Science and Technology? What are philosophical bases of science and technology?
2. **Western and Non-Western historical context of Science and Technology**
 - A. Philosophy of Science and technology in Western Traditions: Aristotle, Pythagoreans, Bacon, Galileo.
 - B. What is western Science, non-western science, ancient science, and modern Science?
 - i. Institutionalisation and professionalization of science
 - ii. Philosophy of Science and technology in Non-Western Traditions: Indian, China, Africa, and others
3. **Philosophical foundations of STS:** STS scholars use diverse methods including social science, historical, and philosophical methods. The outcomes of these research address

issues related science, technology and society, such as those having to do with practices and assumptions, ethics, values, governance, and policy.

4. **Metaphysical foundation of science and ethical issues:** This is time of confusion and uncertainty and this poses a question to the nature of moral obligations, about what to expect for in an afterlife, and about the limits of human knowledge. In the words of Kant: what can we know, what ought we to do, and what can we hope for are the questions for human being and it reflects in our cultures. In this unit we try to look into basis of ethics and its relationship to religion and science.

Essential Readings

- Selin, H. (Ed.) (2008). *Encyclopaedia of the History of Science, Technology, and Medicine in Non-Western Cultures*. Berlin Heidelberg New York: Springer.
- Salomon, Jean-J., Sagasti, F.R., and Sachs-Jeantet, C. (1994). *The uncertain quest: science, technology, and development*. Tokyo: The United Nations University.
- Lloyd, G. and Sivin, N. (2002). *The Way and The Word: Science and Medicine in Early China and Greece*. New Haven: Yale University Press.
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Important Links

<http://vserver1.cscs.lsa.umich.edu/~crshalizi/notabene/scientific-method.ht>

Course No: STI 675

SCIENCE, TECHNOLOGY AND ENVIRONMENT

Semester II/ Optional Paper

(Credits: 03)

Course objectives

The course provided the students with an advanced introduction to the theoretical debates on the relationship between science, technology and environment. What role does science and technology have in creating/accelerating environmental crisis? Can S&T provide solutions to the environmental issues? Do we need a more inclusive paradigm of S&T that pay attention to the perspectives and values of diverse ecological communities? These are the main questions being explored here.

Course description

The course is organised into four units. The first unit discusses the concept of development and introduces the nuances of the theoretical debate on the same. The second unit situates environment as a political problem. The unit also discusses the environmental history of India. The third unit introduces the feminist perspectives on the role of S&T in the ecological crisis. Finally, the Marxist and socialist perspectives on nature-human relationship are introduced to problematize the human-nature relationship. The unit also brings in new theoretical standpoints on the problem and connects them with the question of the role of S&T in catalysing the sustainable and inclusive future.

Mode of Evaluation

Term Papers, book and article reviews and assignments in connection with the modules (Weightage: 50%) along with an End Semester examination (Weightage: 50%). 85 % of attendance is required. Participation in class room discussions and activities is mandatory.

Method of Instruction

Lecture/seminars/ tutorials

UNITS

1. Framing Development

What is development? -development and economy-developmentalism-the development/environment encounter- whose development? -technological projects in India-displacement-project affected people-natural and human made disasters-governmental initiatives in conservation of nature-ecological communities-debate on sustainable development-post-development theory

2. Politics and Ecologies

Does environment have politics? -technologies and ecologies-politicising technology-development of the ecological discourse in India-Gandhian perspectives on S&T and environment-environmental movements-approaches to nature and environment-deep ecology-social ecology- land marks in environmental history-natural resource management

3. The Feminisation of Nature

Ecofeminism and ecosocialism-women, ecology and scientific revolution-gender and environment debates in India-feminist critique of the role of science and technology in the creation of environmental crisis

4. Social Natures and Produced Natures

Marxism and the production of nature-nature as artifice and artefact-rethinking the human place in nature-can we engineer the environment? -S&T: cause of or solution to the ecological crisis?-science, technology and the question of risk-towards a more reflexive S&T which is more ecologically sensible-S&T and sustainable development

Essential Readings

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Recommended Readings

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