

**Curriculum Structure for
M.Sc. (Digital Society)
at
IIT-Bangalore**

17-July-2015



International Institute of Information Technology Bangalore

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1 LEARNING TASKS AND ACHIEVEMENTS

The proposed program aims to create a group of professional practitioners and researchers who possess a nuanced and multi-dimensional understanding of today's information age. It will provide rigorous and broad-based training in the design and development of digital technologies, issues pertaining to the management of complex digital systems and the policy challenges of deploying them. This training will draw from computer science & engineering, data science, design, management, economics, sociology, political science and information science. Structured as a combination of coursework and an internship/thesis, the program will allow students to build a foundation for careers in the government, the corporate world, policy advocacy, academia and social enterprises. As part of the distinctive academic curriculum, students will find immense learning opportunities to work in multi-disciplinary peer groups of the kind they are increasingly likely to encounter in their careers.

2 COURSES: CATEGORIES AND LEVELS

The core curriculum - a set of seven courses, two research method courses, one projective elective and one seminar will strengthen students' foundations in technological and social science approaches to understanding the digital. A series of five electives courses will provide them a specialized skills, as well as future direction to research in various domains. Tables 1 and 2 provide an overview of the curriculum and a summary of the credit distribution in the M.Sc. (Digital Society) program.

3 CURRICULUM STRUCTURE: COMPONENTS AND CREDITS

The following decisions emerged after detailed discussions amongst the members of the curriculum drafting committee and with outside experts, and a study of similar programmes in premier institutions/universities in India and abroad.

- The period of the program will be two years.
- The total number of credits required to fulfill requirements of the program is 76.
- The broad content structure of the proposed program is summarized in Table 1&2

Table 1: Overview of the curriculum

Preparatory Term (2 weeks, 1 course, 2 credits)
Introduction to Digital Societies (Pass/No Pass)
Term 1 (16 weeks, 5 core courses, 18 credits)
Digital Components of a Connected Society (4)
Interface Design for Diverse Populations (4)
Technology and Society (4)
Quantitative Methods (3)
Qualitative Methods (3)
Term 2 (16 weeks, 3 core courses, 1 elective, 16 credits)

Engineering and Management of Large Digital Systems (4) The Digital and Its Discontents (4) Information and Communication Technology Policy and Regulation (4) Elective I (4)
Summer Term (8 weeks, 2 core courses, 6 credits)
Information Management (2) Project Elective (4)
Term 3 (16 weeks, 4 elective courses+1 seminar, 18 credits)
Elective II, III, IV & V (4x4) Seminar (2)
Term 4 (26 weeks, 16 credits)
Thesis/Internship (16)
Total Credits 76

Table 2: Credit distribution

	Proposed Credits	%
Preparatory interdisciplinary orientation	2	2.6
Core courses	26	34.2
Research Methods	6	7.8
Project	4	5.2
Elective course credits	20	26.3
Internship/Thesis credits	16	21
Seminar	2	2.6
Total credits requirement for M.Sc. (Digital Society)	76	100

4 COURSES

Core Courses

Students will be required to take seven courses, two research methods courses, a project and a seminar as core courses. All of these will be specifically designed keeping in mind the needs of a heterogeneous student body. Courses will provide students an understanding of technology fundamentals and a constructive critical lens to analyze how digital technologies work in the social world. The goal is to provide fundamentals to students from different backgrounds, without forcing them to repeat material they already know well. For the courses on technology fundamentals, we do this by focusing on particular dimensions of technology design and deployments such as their scale and diversity of audience,

dimensions and examples that even technology students are unlikely to have encountered. Similarly, for those with a social science background, the focus on digital technologies as the object of social analysis will set the social science courses apart. The course on Research Methods will enable students to examine user needs and outcomes, and to evaluate the impact of ICTs. The project elective in the summer semester will allow students to consolidate their learning from multiple core courses, while the seminar in the third semester will provide them an opportunity to think through the questions they will tackle in their upcoming thesis/internship.

4.1 Preparatory Term Courses

We expect a diverse student body that represents many disciplines. Given this heterogeneity in background, we propose a mandatory introductory course of two weeks to prepare students to learn and work together in the following semesters.

- ***Introduction to Digital Societies (2 credit, Pass/Not Pass)***

This is a two-week introduction to the MSc (Digital Society) program. It will provide students an overview of the course structure, course requirements, and rationale for the core and elective course offerings in the program. A combination of lectures, readings, and audio-visual material will be used to introduce the fundamentals and the epistemological approaches of technologies and the social sciences to a disciplinarily diverse student body. Students will be exposed to the foundational logic of the program and its interdisciplinary underpinnings with an overview of the conceptual toolkit for designing a digital society.

Students will be required to complete a group assignment based on the preparatory term modules.

4.2 Term 1 Courses

- ***Digital Components of a Connected Society (4 credits)***

The Digital Society is a result of a large number of digital components that were developed in the last 75 years around digital computer to communicate, store and process data. This course gives an overview of the network of computing devices and communication links which has made the Digital Society possible. Students attending this course will gain an understanding of some of the digital components, their interconnections and their role in the connected world.

- ***Interface Design for Diverse Populations (4)***

This course deals with User Interface design specifically in the context of ICT applications. ICT applications that are rolled out online have a unique challenge of being accessible to wide cross sections of the population involving diversity in language, literacy levels, technology availability and cultural preferences. Students completing this course will have had an exposure to user interface design that is agnostic to specific demographics of the population. The course would focus on generic principles of UI design (learnability, visibility, error prevention, efficiency, and graphic design), key technologies that are in vogue and policy aspects relating accessibility. All this will be discussed in relation to the human capabilities (including perception, motor skills, color vision, attention, and human error) that motivate the need for effective UI design.

- ***Technology and Society (4 credits)***

Technology can be studied in its different dimension as it comprises of facts, artifacts, know-how, processes and last but not the least contexts. Understanding the context of technology turns our focus to the relationship between technology and society. The relationship between technology and society is an established field of studies within social sciences and humanities. This introductory course, notwithstanding the depth and magnitude of this field of studies, provides a preliminary and cursory overview of all these approaches across three aspects of technology, such as production of technology, consumption/reception of technology and impact of technology. In analyzing these varied aspects of technology this course will serve a basic objective, that is, to demonstrate how the relationship between technology and society is mutually inclusive.’ The main objective of the course is to expose students to non-deterministic ways of thinking about technology.

- ***Quantitative Methods(3 credits)***

The course will provide students an overview of their statistical foundations. It will equip students with methods pertaining to collecting and describing quantitative data including sampling methods and measures of location (central tendency), dispersion and distribution. The course will also train students in using appropriate analytical methods including linear regression models and inferential procedures as part of analyzing quantitative data. In addition to learning about these descriptive and inferential statistical methods and models of quantitative research conceptually, the students will be given computer-based exercises to perform quantitative analysis.

- ***Qualitative Methods (3 credits)***

This course will provide an overview of the philosophical foundations of qualitative research methodologies. It will introduce the students to the major forms of qualitative research methods such as, life histories, focus groups, participation-observation, action research, and ethnographies. The course will train students to analyze the ethical implications, the strengths and limitations of each of the methods, the conditions under which each of the methods is used, as well as the generalizability and purpose of each of the methods. In addition, students will be trained in analyzing and presenting the different forms of data collected through these methods.

4.3 Term 2 Courses

- ***Engineering and Management of Large Digital Systems (4 credits)***

A recent research study by University of Oxford and McKinsey & Company reveals that 71% of large IT projects face cost overruns and 33% are more than 50% over budget; they are also found to deliver 56% less value than predicted¹. This is often a result of inconsistencies in managing the design and deployment processes in these projects and it is this that the proposed course will be concerned with. Students will be introduced to conceptual frameworks and practices involved in the engineering of IT projects drawn largely from theoretical positions developed in the discipline of software engineering related to requirements specification, system architecture, design and testing and process maturity models in the first part of the course. The second part will introduce the principles involved in managing project

¹ http://www.mckinsey.com/insights/business_technology/developing_talent_for_large_it_projects

implementation covering aspects such as project planning, scheduling, resource allocations and tracking, risk and change management etc. To the extent feasible, relevant modules from the project management methodology developed by Project Management Institute will be used to illustrate these project management principles.

- ***The Digital and Its Discontents (4 credits)***

This course explores the multiplicity of social inequalities in India and the ways in which development thinking is linked to them in our contemporary digital society. Students will be trained to recognize and analyze social divides such as gender, caste, class, and region. The course will provide students a framework to examine how these divides have been progressively conceptualized and addressed with the trajectory of development discourse since post-war times as an example. While presenting a comprehensive analysis of different theories and practices of development, this course will focus on two dimensions: first, how are some of the classical inequalities and debates of development reproduced in the digital space and, second, how does the digital space give birth to new issues of contestation within the broader development discourse. This course will serve as a crucial bridge for students to pursue electives such as Internet and Identity, Gender and ICT, E-Governance and Democracy, ICT in Education, Digital Technologies for Healthcare, and Technology and Poverty in subsequent semesters.

- ***Information and Communication Technology Policy and Regulation²(4 credits)***

This course will provide an overview of how laws, technology and economics shape public policies of the ICT sector. It will focus on how laws can be used to influence and guide technological change; the underlying regulatory economics that form the basis of policies; responses of the legal system to social and ethical problems created by new or existing technology; and how emerging technologies can be nurtured and governed through innovative policies and regulation. In particular this course will cover topics including telecommunications and Internet regulation; privacy and freedom of speech; intellectual property rights; standards setting; universal access to information and communication technologies.

- ***Elective I (4 credits)***

To be selected from amongst the list of approved electives for the M.Sc. (DS) programme. A tentative list is provided below.

4.4 Summer Term Courses

- ***Information Management (2 credits)***

Information Management is an area of study that deals with different aspects dealing with digital information. The specific topics of relevance to this course are information modeling, information storage and retrieval. After they complete this course, the students should be able to pursue next level courses in the areas of software application development, data analysis, information architecture and so on.

- ***Project Elective (4 credits)***

This project elective requires students to apply insights from their courses in semesters 1 and 2,

² <http://student.mit.edu/catalog/search.cgi?search=ESD.132&style=verbatim>

particularly the courses on large digital systems, and interface design. A module on technical communication will be integrated into the project elective to enhance student presentations on the research process and their findings/ conclusions.

4.5 Term 3 Courses

- *Seminar (2 credits)*

Students will present their plans for their thesis or internship in this seminar. They will discuss their research questions, or work goals, including how they are thinking about the next semester in view of their insights from their course and project work.

- *Electives II, III, IV and V (4x4 credits)*

To be selected from amongst the list of approved electives for the M.Sc. (DS) programme. A tentative list is provided below.

Electives

Students are required to take five elective courses from a list of open electives and a project elective. Table 3 provides an indicative (not exhaustive) list of electives that will be made available to students in their second and third semesters. Electives will focus on specific technologies such as cloud or mobile platforms, social media and spatial-information systems; data analytics; human-computer interaction and/or domain-specific understanding of the technology-society interface, including issues pertaining to education, governance, gender, identity, poverty, and public health. Special attention will be given to provide enough options in both technology and social science electives, so that students can take up electives depending on their specific interests in sectors and domain pertaining to the “digital”.

Table 3: Tentative List of Open Electives

<ul style="list-style-type: none"> • Dynamics of IT Industry • E governance and Democracy • Gender and Technology • Internet and Identity • ICT in Education • ICT Contract Management • Open Data and Transparency • Techno-economics of Networks • Technology and Poverty 	<ul style="list-style-type: none"> • Digital Technologies for Healthcare • Geographic Information Systems • Human Computer Interaction • Mobile Technologies for Social Sector • Web Science • Advanced Research Methods • ICT Product Development and Management
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**Students can also take maximum one course from already existing courses for MTech given they meet the prerequisite criteria as set by the instructors. This limit does not apply to courses which are cross listed between M.Tech and M.Sc.(DS).*

5 TERM 4: THESIS/INTERNSHIP

The 4th term will consist of a 26-week thesis/internship. Students will earn 16 credits on its successful completion.

For the students pursuing Internship:

- Internships are six months (not less than five months) of supervised project work carried out at any of the relevant institutes in public, private and social sector or at academic institutions.
- The internship committee will ensure that mid-term feedback is collected for every student pursuing internship to ensure smooth progress towards completion.
- At the time of internship completion, the internship committee will also collect the certificate (satisfactory/unsatisfactory) from concerned persons at the organization. If the certificate is unsatisfactory, the institute internship committee will review the matter. If they agree with the certificate given, the student has to repeat the internship at the same or different organization. If the certificate is satisfactory, the student fulfills the requirements of internship.

For students pursuing the Thesis option, the following guidelines hold:

- There will be a thesis committee modeled after the MTech thesis committee comprising the supervisor and at least two more faculty members. Members of this thesis committee will serve as thesis and oral examiners for each student pursuing the thesis option.
- The thesis style rules will be available on LMS for all thesis students to use.
- A soft copy of the thesis in .pdf format should be sent to the IITB librarian a week before the final submission of thesis date according to the institute's calendar (which will be after the thesis oral exam). The librarian must officially approve the soft copy of the thesis before it is sent out to be printed or bound.
- This program will follow the existing MTech academic calendar with fixed dates for the following tasks specific to thesis evaluation: constitution of thesis committee, submission of draft to the committee(s) (a week before the oral examination), a week dedicated for all the MTech thesis defenses, date for submission of soft copy to the librarian, and a date for final submission of the hardbound thesis to the library.

The above rules are the same as the regular MTech guidelines for Thesis and Internship.

APPENDIX: DESCRIPTION OF CORE COURSES

Course Name	Digital Components of a Connected Society	
Course Branch	MSc (Digital Society)	
Course Proposer Name(s)	Prof. PG Poonacha	
Course Instructor Name(s)	Prof. PG Poonacha	
Course Type	Core	
Course Level	Level 1	
Credits (L:T:P) (Lecture : Tutorial : Practical)	4 Credits	
Grading Scheme	A,A-,B+,B,B-,C+,C,D,F	
Pre-Requisites		
None		
Course Description		
The Digital Society is a result of a large number of digital components that were developed in the last 75 years around digital computer to communicate, store and process data. This course gives an overview of the network of computing devices and communication links which has made the Digital Society possible.		
Course Outcomes		
<ul style="list-style-type: none"> • Understanding the role of different digital components in the connected world • Good understanding of some of the components and their interconnections 		
Course Content		
Computers: Binary representation and Basic Arithmetic. Computer Architecture. Operating Systems and compilers		
Communication: Basics of Digital Transmission and characteristic of Radio propagation. Narrow-band cellular systems (GSM). Wideband Cellular Systems (CDMA, OFDM).		
Data Networks: Access Mechanisms and Quality of Service Metrics		
Internet Network architecture. FTP, HTTP and WWW, Servers, Gateways and clouds. Privacy and Security Issues over Internet. Simple examples to achieve privacy and security.		

Wireless sensor network architectures, communication protocols and Internet of Things/Humans
Assessments / Grading
<p>Suggested assessment criteria:</p> <ul style="list-style-type: none"> • Assignments --- 20% • Midterm Exam – 20% • Paper submission/presentation. Some general reading references are given below - 30% • End Sem Exam – 20%
Text Book / References
<p>Articles from : http://www.internetsociety.org Articles from IEEE Magazines and web. Cellular Technologies For Emerging Markets 2G, 3G And Beyond Ajay R. Mishra Nokia Siemens Networks, John Wiley and Sons, 2010 General Reading: References: The Zero Marginal Cost Society: The Internet of Things, the Collaborative Commons, and the Eclipse of Capitalism – 2014 Jeremy Rifkin The Third Industrial Revolution: How Lateral Power Is Transforming Energy, the Economy, and the World, 2013, Jeremy Rifkin The Rise of the Network Society: The Information Age: Economy, Society, and Culture Volume I Paperback – August 17, 2009by Manuel Castells</p>

Course Name	Interface Design for Diverse Populations
Course Branch	MSc (Digital Society)
Course Proposer Name(s)	Prof. G.Srinivasaraghavan
Course Instructor Name(s)	TBD
Course Type (Select one)	Core
Course Level (Select one)	Level 1
Credits (L:T:P) (Lecture : Tutorial : Practical)	4 Credits
Grading Scheme	A,A-,B+,B,B-,C+,C,D,F
Pre-Requisites (where applicable, specify exact course names)	
None	
Course Description	
This course deals with User Interface design specifically in the context of ICT applications. ICT applications that are rolled out online have a unique challenge of being accessible to wide cross sections of the population involving diversity in language, literacy levels, technology availability and cultural preferences.	
Course Outcomes	
At the end of this course, following are expected outcomes. The student is expected to UNDERSTAND:	
<ul style="list-style-type: none"> • role of effective UI in the success of an ICT program • the UI layer in relation to the entire 'stack' • tradeoffs in UI design – heavy vs thin UI, functional vs aesthetic, design thinking vs ease of implementation, accessibility vs comprehensiveness, text based vs text free, etc. • integration of multiple interface options – voice, audio, video, text, pictures, choice of external devices, devices on which the UI will be viewed, etc. • integration of toolkits, apis etc provided by third parties for quick implementations 	
The student is expected to KNOW:	
<ul style="list-style-type: none"> • what constitutes good UI design – color schemes, choice of appropriate themes, visual branding, principles of navigation, etc. • methods to validate the effectiveness of a UI, experiment design, field studies, metrics to evaluate UI, etc. • data collection methods to understand the 'audience' towards a better UI design • different technology options available to a UI designer and supporting tools • policy issues relating to accessibility and possible technology solutions 	

- making interfaces compatible with multiple devices- mobile, smartphone, tablets, laptops, ...
- building low-fidelity prototypes that can be demonstrated quickly

The student is expected to DO:

- critique the UI of an existing ICT application
- create an interface for a sample audience and a sample application from the scratch (involving the entire life-cycle – data collection from a survey, building the UI, validation and usability testing)

Course Content

Students completing this course will have had an exposure to user interface design that is agnostic to specific demographics of the population. The course would focus on generic principles of UI design (learnability, visibility, error prevention, efficiency, and graphic design), key technologies that are in vogue and policy aspects relating accessibility. All this will be discussed in relation to the human capabilities (including perception, motor skills, color vision, attention, and human error) that motivate the need for effective UI design.

Assessments / Grading

Suggested assessment criteria:

- Mini-assignments --- 20%
- Quizzes – 15%
- Case Study – 20%
- Project – 45%

Text Book / References

The following is the highly recommended standard textbook for UI design.

Mullet, Kevin, and Darrell Sano. *Designing Visual Interfaces: Communication Oriented Techniques*. Prentice Hall, 1994. ISBN: 9780133033892.

The following textbooks and study materials are recommended as additional reference:

- Baecker, Ronald M., Jonathan Grudin, et al. *Readings in Human-Computer Interaction: Toward the Year 2000*. 2nd ed. Morgan Kaufmann, 1995. ISBN: 9781558602465. [Preview with [Google Books](#)]
- Raskin, Jef. *The Humane Interface: New Directions for Designing Interactive Systems*. Addison-Wesley Professional, 2000. ISBN: 9780201379372. [Preview with [Google Books](#)]
- Jhonson, Jeff. *GUI Bloopers: Don'ts and Do's for Software Developers and Web Designers (Interactive Technologies)*. Morgan Kaufmann, 2000. ISBN: 9781558605824. [Preview with [Google Books](#)]
- Card, Stuart K., Thomas P. Moran, and Allen Newell, eds. *The Psychology of Human-Computer Interaction*. Lawrence Erlbaum, 1983. ISBN: 9780898592436. [Preview with [Google Books](#)]

Course Name	Qualitative Methods	
Course Branch	MSc (Digital Society)	
Course Proposer Name(s)	Prof. Jillet Sarah Sam	
Course Instructor Name(s)	Prof. Jillet Sarah Sam	
Course Type	Core	
Course Level	Level 1	
Credits (L:T:P) (Lecture : Tutorial : Practical)	3 credits	
Grading Scheme	(A,A-,B+,B,B-,C+,C,D,F)	
Pre-Requisites (where applicable, specify exact course names)		
None		
Course Description		
<p>This course will provide an overview of the philosophical foundations of qualitative research methodologies and introduce the students to the major forms of qualitative research methods. The course will train students to analyze the ethical implications, the strengths and limitations of each of the methods, the conditions under which each of the methods is used, as well as the generalizability and purpose of each of the methods. In addition to learning about specific methods such as life histories, focus groups, participation-observation, action research, and ethnographies, the students will be trained in analyzing and presenting the different forms of data collected through these methods.</p>		
Course Outcomes		
<p>At the end of this course, following are expected outcomes.</p> <p>The student is expected to UNDERSTAND:</p> <ul style="list-style-type: none"> • understand how to match particular methodologies to the theoretical framework and research problem • understand different epistemological approaches to qualitative methods; • understand different qualitative data analysis methods; • understand issues around qualitative research design <p>The student is expected to DO:</p> <ul style="list-style-type: none"> • critically appreciate the use and implementation of different qualitative methodologies in peer research • design, implement and report a qualitative research project 		
Course Content		

Module 1: Introduction to Epistemological Approaches

Module 2: Research Design: Validity, Reliability, Ethics

Module 3: Interviews

Module 4: Focus Group Interviews

Module 5: Case Study Method

Module 6: Content Analysis versus Discourse Analysis

Module 7: Life Histories

Module 8: Ethnography

Module 9: Ethnographies of the Digital

Module 9: Action Research

Module 10: Analysing and Writing Qualitative Data

Assessment/Grading

Suggested assessment criteria:

- Weekly Online Reflection Posts – 10 %
- Research Paper Reviews – 15 %
- Research Spotlight Presentations – 20 %
- Mini-assignments – 15%
- Project – 25%
- Class Participation – 10 %

References

The following is a list of required references:

Geertz, Clifford (1973). *The Interpretation of Cultures*. New York: Basic Books Inc.

Hine, Christine (2005) *Virtual Methods: Issues in Social Science Research on the Internet*. Oxford; New York: Berg.

Jones, Steve (1999) *Doing Internet Research: Critical Issues and Methods for Examining the Net*. Thousand Oaks, CA: Sage.

Markham, Annette and Nancy Baym. (2009) *Internet Inquiry: Conversations about Method*. Thousand Oaks, CA: Sage.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Thousand Oaks, CA: Sage.

Wolcott, H. F. (2002). *Sneaky kid and its aftermath: Ethics and intimacy in fieldwork*. Walnut Creek, CA: Alta Mira Press.

Wolcott, H. F. (1994). *Transforming qualitative data: Description, analysis, and interpretation*. Thousand

Oaks, CA: Sage.

Warren, C.A.B. & Karner, Tracy X. (2005). *Discovering qualitative methods: Field research, interviews, and analysis*. CA: Roxbury Publishing Company.

Course Name	Quantitative Methods	
Course Branch	MSc (Digital Society)	
Course Proposer Name(s)	Prof. Amit Prakash & Dr.Mandar Kulkarni	
Course Instructor Name(s)	Prof. Amit Prakash & Dr.Mandar Kulkarni	
Course Type	Core	
Course Level	Level 1	
Credits (L:T:P) (Lecture : Tutorial : Practical)	3 credits	
Grading Scheme	(A,A-,B+,B,B-,C+,C,D,F)	
Pre-Requisites (where applicable, specify exact course names)		
None		
Course Description		
<p>This course will provide students with an overview of the statistical foundations of quantitative research methodologies and introduce them some of the major techniques of quantitative research. The course will equip the students with methods pertaining to collecting and describing quantitative data including sampling methods and measures of location (central tendency), dispersion and distribution. The course will also train students in using appropriate analytical methods including linear regression models and inferential procedures as part of analyzing quantitative data. In addition to learning about these descriptive and inferential statistical methods and models of quantitative research conceptually, the students will be given computer-based exercises to perform quantitative analysis.</p>		
Course Outcomes		
<p>At the end of this course, following are expected outcomes.</p> <p>The student is expected to UNDERSTAND and KNOW:</p> <ul style="list-style-type: none"> • Methods of quantitative research and processes pertaining to data analysis to be able to conduct research in an organized manner. • Quantitative techniques and the theories underpinning them to be able to perform data collection, description, analysis and interpretation. • Basic and intermediate level statistical methods and their application. • Application of quantitative methods using Excel and other computer-based statistical software. <p>The student is expected to DO:</p> <ul style="list-style-type: none"> • Research projects involving data collection (either primary and/or secondary) and analysis • Presentation of projects based on quantitative methods. 		
Course Content		

1. **Introduction:** Course overview. Fundamentals of quantitative research methodology. Introduction to the key issues of research process including the significance of social research, data collection, processing and analysis, methodology, and the key principles of scientific investigation.
2. **Probability Theory:** Introduction to Sample Space and Events. Probability Law — Interpretation of probability, Axioms of probability, Conditional probability, Random variables, Prior/Posterior probability.
3. **Statistical and Distribution Theory:** Discrete random variables —Basic concepts, Probability Mass Functions. Continuous random variables — Basic concepts, Probability Density Functions. Introduction to Cumulative Distribution Functions. The Binomial distribution, the Poisson distribution, Conditional distributions, the Normal distribution and related distributions.
4. **Sampling and Sampling Distributions:** Introduction to Sampling and Sampling distributions, Basic Experimental designs including experimental validity and types of variables, Sample size and Standard error.
5. **Inferential Statistics:** Understanding statistical significance. Key types of statistical inference — Point estimation, Hypothesis testing, and Set estimation. Discussion of Known/Unknown variances. One-sample/two-sample tests — t-Tests, Analysis of variance and covariance.
6. **Basic Statistical Analysis:** Quantification of population attributes including descriptive statistics and Graphical representation. Univariate Analysis — Marginals, Measures of central tendency and variability, and Grouping and recoding data. Bivariate Analysis — Cross-Tabulation and Chi-square, Measures of Association (Correlation). The Plug-in estimates.
7. **Multivariate Analysis:** Multivariate Analysis — Simple Linear Regression including regression line, method of least squares, regression model and diagnostics. Limited Dependent Variable Models — Logit and Probit models.
8. **Limit Theorems:** Introduction to the Weak Law of Large Numbers, Convergence in Probability, The Central Limit Theorem, The Strong Law of Large Numbers.

Assessments / Grading

Suggested assessment criteria:

- Mini-assignments --- 20%
- Quizzes – 10%
- Project – 30%
- Exam – 40%

Text Book / References

Reference Books

- Levin, R. I., and Rubin, D. S. (1995). *Statistics for Management*, Sixth Edition. New Delhi, India: Prentice-Hall of India Private Limited. ISBN: 81-203-0893-X.
- Trosset, M. W. (2009). *An Introduction to Statistical Inference and Its Application with R*. Chapman and Hall/CRC. ISBN-13: 978-1584889472; ISBN-10: 1584889470.
- Vanderstoep, S. W., and Johnston, D. D. (2009). *Research Methods for Everyday Life: Blending Qualitative and Quantitative Approaches*. San Francisco, CA: Jossey-Bass, A Wiley Imprint. ISBN: 978-0-470-34353-1.
- Gray, P. S., Williamson, J. B., Karp, D. A., and Dalphin, J. R. (2007). *The Research Imagination: An Introduction to Qualitative and Quantitative Methods*. Cambridge, UK: Cambridge University Press. ISBN-13: 978-0-521-70555-4; ISBN-10: 0-521-70555-X.
- Bertsekas, D. P., and Tsitsiklis, J. N. (2002). *Introduction to Probability*. Massachusetts, USA: Athena Scientific. ISBN: 1-886529-40-X.

Course Name	Technology and Society
Course Branch	MSc (Digital Society)
Course Proposer Name(s)	Prof. Bidisha Chaudhuri
Course Instructor Name(s)	Prof. Bidisha Chaudhuri
Course Type	Core
Course Level	Level 1
Credits (L:T:P) (Lecture : Tutorial : Practical)	4 credits
Grading Scheme	A,A-,B+,B,B-,C+,C,D,F
Pre-Requisites (where applicable, specify exact course names)	
NA	
Course Description	
<p>Technology can be studied in its different dimension as it comprises of facts, artifacts, know-how, processes and last but not the least contexts. Understanding the context of technology turns our focus to the relationship between technology and society. The relationship between technology and society is an established field of studies within social sciences and humanities. This introductory course, notwithstanding the depth and magnitude of this field of studies, provides a preliminary and cursory overview of all these approaches across three aspects of technology, such as production of technology, consumption/reception of technology and impact of technology. In analyzing these varied aspects of technology this course will serve a basic objective, that is, to demonstrate how the relationship between technology and society is mutually inclusive.’</p>	
Course Outcomes	
<p>By the end of the course students are expected to Understand and Know:</p> <p>Theoretical insights, current discourses and key concepts relating to the study of technology within social sciences and humanities and the link between a concrete problem of technology and its interpretation and manifestation in the wider social context.</p> <p>Students are expected to DO:</p> <p>Critically appraise non-deterministic ways of thinking about technology.</p>	
Course Content	
<p>Module 1: Introduction- Why we need to study the relationship between technology and society</p> <p>Module 2: Science and Technology in Social Sciences: An Overview</p>	

Module 3: History of Technology
Module 4: Philosophy of Technology
Module 5: Technology and Politics
Module 6: Social Construction of Technology: Consumption, Reception and Interpretations
Module 7: Technology, Human Development and Ethics
Module 8: Challenges and Concerns of Technology Studies in Social Sciences
Assessments (optional for Special Topics courses)
The evaluation scheme will be as indicated below. The percentages shown denote the contribution of that activity towards the final grade. <ul style="list-style-type: none"> • Class Participation (20%): Attendance + Participation in Class Activities • Weekly Reading Assignments and Individual Presentation (30%) • Mid-term paper (20%): • End-term paper (30%):
Books / References
<p>Books (selected chapters):</p> <ul style="list-style-type: none"> • Avgerou, Chrisanthi, Claudio Ciborra and Frank Land. The Social Study of Information and Communication Technology: Innovations, Actors and Contexts. Oxford University Press, 2004 • Bauchspies, Wenda K. et al. Science, Technology, and Society: A Sociological Approach. London: Blackwell, 2006 • Bijker, W.E. Of Bicycles, Bakelites and Bulbs: Toward a Theory of Sociotechnical Change. MIT Press, 1997 • Feenberg, Andrew. Between Reason and Experience: Essays in Technology and Modernity. MIT Press, 2010 • MacKenzie, Donald, and Judy Wajcman. The social shaping of technology. Open University Press, 1999 • Mucha, Janusz and Katarzyna Leszczyńska (ed.) Society, Culture and Technology at the Dawn of 21st Century, UK: Cambridge Scholar Publishing, • Olsen, Jan Kyrre Berg , Stig Andur Pedersen, Vincent F. Hendricks (eds.)A Companion to the Philosophy of Technology. Willey-Blackwell, 2012 • Sismondo, Sergio. An Introduction to Science and Technology Studies. London: Blackwell, 2010 <p>Journal Articles:</p> <ul style="list-style-type: none"> • Barley, Stephen R. "What can we learn from the history of technology?." Journal of Engineering and Technology Management 15.4 (1998): 237-255 • Bijker, W.E. Of Bicycles, Bakelites and Bulbs: Toward a Theory of Sociotechnical Change. MIT

Press, 1997

- Bromley, D. Allan. "Science, technology, and politics." *Technology in Society* 24.1 (2002): 9-26
- Marx, Leo. "Technology The Emergence of a Hazardous Concept" *Technology and Culture*, 51(3), July 2010, pp. 561-577
- Winner, Langdon. "Upon opening the black box and finding it empty: Social constructivism and the philosophy of technology." *Science, Technology, & Human Values* 18.3 (1993): 362-378

Additional readings will be circulated as and when required.

Course Name	Engineering and Management of Large Digital Systems
Courses Branch	MSc (Digital Society)
Course Proposer Name(s)	Prof. Amit Prakash
Course Instructor Name(s)	Prof. Amit Prakash
Course Type	Core
Credits (L:T:P) (Lecture : Tutorial : Practical)	4 credits
Grading Scheme	,A-,B+,B,B-,C+,C,D,F
Pre-Requisites (where applicable, specify exact course names)	
NA	
Course Description	
<p>A recent research study by University of Oxford and McKinsey & Company reveals that 71% of large IT projects face cost overruns and 33% are more than 50% over budget; they are also found to deliver 56% less value than predicted. This is often a result of inconsistencies in managing the design and deployment processes in these projects and it is this that the proposed course will be concerned with. Students will be introduced to conceptual frameworks and practices involved in the engineering of IT projects drawn largely from theoretical positions developed in the discipline of systems engineering related to requirements specification, system architecture, design and testing and process maturity models in the first part of the course. The second part will introduce the principles involved in managing project implementation covering aspects such as project planning, scheduling, resource allocations and tracking, risk and change management etc. To the extent feasible, relevant modules from the project management methodology developed by Project Management Institute will be used to illustrate these project management principles.</p>	
Course Outcome	
<p>At the end of the course students are expected to UNDERSTAND :</p> <ul style="list-style-type: none"> • The basic concepts of systems engineering and its various constituents • The various processes involved in the design of IT systems including in the phases of requirement specification, conceptual, preliminary and component level architecture and design • The need for adopting sound project management practices while implementing/deploying large digital systems. They will also get introduced to good practices involved in various aspects of managing projects based on accepted methodologies. <p>They are expected to do:</p> <ul style="list-style-type: none"> • Draft requirement specifications and high-level system design documents that can lead into RFPs in case of external procurement • Develop project plans and schedules and manage various project activities over an entire project life-cycle • Measure project progress and prepare reports and other documents needed for communicating with internal and external project stakeholders 	
Course Content	

Part I: Engineering systems

- Introduction to systems engineering
- Process models
- Requirements analysis and modeling
- Architectural and component-level design
- Testing strategies and approaches

Part II: Managing projects

- Project planning and scheduling
- Scope, time and cost management
- Risk management; Quality management
- Stakeholder and Communications management
- Project metrics and measurement

Assessments/Grading

Students will be assessed based on their participation in class discussions, submission of written assignments and class presentations and performance in quizzes and exams. The proposed weightage for various components is as follows:

- Class participation/presentation: 10%
- Assignments: 20%
- Class quizzes: 20%
- Mid term Exam: 25%
- End Term Exam: 25%

Text Book / References*For Part I (Engineering systems)*

- Michael J. Ryan and R. Ian Faulconbridge. 2014. Systems Engineering Practice. ArgosPress.
- Olivier L. de Weck, Daniel Roos and Christopher L. Magee. 2011. Engineering Systems: Meeting Human Needs in a Complex Technological World. MIT Press.
- Roger S. Pressman. 2005. Software Engineering: A Practitioner's Approach (Sixth Edition). McGraw Hill.

For Part II (Managing projects)

- A Guide to the Project Management Body of Knowledge (Fifth Edition). Project Management Institute. 2013.
- Scott Berkun. 2008. Making Things Happen: Mastering Project Management (Theory in Practice). O'Reilly.

Other relevant references drawn from research and practitioner articles will also be used for various topics, wherever required.

Course Name	The Digital and its Discontents	
Course Branch	MSc (Digital Society)	
Course Proposer Name(s)	Prof. Janaki Srinivasan	
Course Instructor Name(s)	Prof. Janaki Srinivasan	
Course Type	Core	
Course Level	Level 1	
Credits (L:T:P) (Lecture : Tutorial : Practical)	4 credits	
Grading Scheme	(A,A-,B+,B,B-,C+,C,D,F)	
Pre-Requisites <i>(where applicable, specify exact course names)</i>		
None		
Course Description		
<p>This course explores how the digital space shapes a multiplicity of social inequalities in contemporary society. Students will be trained to recognize social divides rooted in gender, caste, race, class, and region, and understand how these divides have been progressively conceptualized and addressed. The course will focus on two dimensions of social divides in the digital era: first, how classical inequalities and debates about them are reproduced in the digital space and, second, how the digital space might open up opportunities to challenge these divides. A majority of the course will be focused on examining these themes with the example of socio-economic divides and the trajectory of development thinking since the 1950s. This course will serve as a crucial bridge for students to pursue electives such as Internet and Identity, Gender and ICT, E-Governance and Democracy, ICT in Education, Digital Technologies for Healthcare, and Technology and Poverty in subsequent semesters.</p>		
Course Outcomes		
<p>At the end of this course, following are expected outcomes.</p> <p>The student is expected to UNDERSTAND and KNOW:</p> <ul style="list-style-type: none"> • Types of social divides, and their roots in gender, class, caste, race and region • Theories of development and contemporary debates around them <p>The student is expected to DO:</p> <ul style="list-style-type: none"> • Apply understanding of social divides to the reproduction and contestation of social divides in the design, deployment and use of digital technologies • 		

Course Content
<p>Module 1: Divides, Digital and Social (2 weeks)</p> <ul style="list-style-type: none"> • The roots of social divides • Implications of divides for design, deployment and use of Digital Tools and Spaces • Studying divides using the example of development theory and practice <p>Module 2: Theories and critiques of Development (8 weeks)</p> <ul style="list-style-type: none"> • The Modernization approach • Dependency Theory • Washington Consensus and the Neo-Liberal Turn • Post-Development Critiques <p>Module 3: Identifying divides in the digital era (5 weeks)</p> <ul style="list-style-type: none"> • Divides in technology design and manufacturing • Divides in access • Divides in use
Assessments / Grading
<p>Suggested assessment criteria:</p> <ul style="list-style-type: none"> • Class participation --- 10% • Weekly reading responses --- 20% • Mid-term group assignment --- 30% • End-term assignment (paper/project) --- 40%
Text Book / References
<ul style="list-style-type: none"> • There is no single prescribed textbook for this course. Students will rely on lecture notes and assigned readings (excerpted from books or articles, a few of which are mentioned below): • Webster, Frank. 2006. <i>Theories of the Information Society</i>. London; New York: Routledge. • W. W. Rostow, 1960. <i>The Stages of Economic Growth: A Non-Communist Manifesto</i> Cambridge: Cambridge University Press. • Andre Gunder Frank. 1966 'The Development of Underdevelopment,' <i>Monthly Review</i> (18) : pp. 17-31. • Easterly, William R. 2002. <i>The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics</i>. Reprint edition. Cambridge, Mass.: The MIT Press. • Escobar, Arturo. 1995. <i>Encountering Development: The Making and Unmaking of the Third World</i>.

Course Name	Information and Communication Technology Policy and Regulation	
Course Branch	MSc (Digital Society)	
Course Proposer Name(s)	Prof. V.Sridhar	
Course Instructor Name(s)	Prof. V. Sridhar	
Course Type	Core	
Course Level (<i>Select one</i>)	Level 1	
Credits (L:T:P) (Lecture : Tutorial : Practical)	4 credits	
Grading Scheme	(A,A-,B+,B,B-,C+,C,D,F)	
Pre-Requisites <i>(where applicable, specify exact course names)</i>		
None		
Course Description		
<p>There is a paradigm shift in the ICT industry today due to convergence in various technologies and services, the ubiquity of the Internet, the pervasiveness of social media and peer-to-peer networking, the intelligence of terminal devices and applications, and the voluminous data that is being collected by networks and networking firms. These pose challenges in the areas of privacy, security, market power, pricing, interconnection, radio spectrum management, industry structure and Intellectual Property Rights. This course provides the theoretical and policy base for analyzing these issues.</p>		
Course Outcomes		
<p>At the end of this course, following are expected outcomes.</p> <p>The student is expected to UNDERSTAND and KNOW:</p> <ol style="list-style-type: none"> 1. Regulatory aspects of telecom: interconnection, universal services, pricing, ex-ante vs. ex-post 2. Radio spectrum regulation and management: International practices and India case study; coexistence of licensed and unlicensed spectrum, spectrum commons, flexible spectrum management 3. Convergence of telecom and Internet and associated regulatory and policy implications: net neutrality 4. Privacy and security issues in ICT and associated regulatory and policy implications; best International practices 5. Intellectual Property Rights/ Copyrights/ data protection laws and regulation; 6. Policy modeling tools such as what-if analysis, system dynamics modeling 		

<p>The student is expected to DO:</p> <ul style="list-style-type: none"> • Comparative policy analysis • Prepare regulatory and policy consultation papers
<p>Course Content</p>
<p>The course is on regulations and policy of the ICT sector and covers topics such as: price regulation, market power analysis, universal service policies, interconnection economics, IPR/ copyright policies and laws, international regulations, content regulation and policies, radio spectrum policies, convergence policies, privacy and security of data and networks and associated policies, data protection laws, e-commerce laws and policies. The above topics are covered with appropriate theories drawn from regulatory economics, information economics, and techno-economic principles.</p>
<p>Assessments / Grading</p>
<p>Suggested assessment criteria:</p> <ul style="list-style-type: none"> • Discussion papers ---10% • Quizzes –20% • Policy paper – 20% • Exams – 50%
<p>Text Book / References</p>
<p>Reference Books</p> <ul style="list-style-type: none"> • Nuechterlein, J., & Weiser, P. (2005). “Digital Crossroads”. Cambridge, MA: MIT Press. • Oz Shy, “The Economics of Network Industries”, Cambridge University Press, 2001. • Prasad, R., and Sridhar, V. (2014). <i>The Dynamics of spectrum management: Legacy, Technology and Economics</i>. New Delhi, India: Oxford University Press, ISBN-13: 978-0-19-809978-9; ISBN-10: 0-19-809978-9. • Sridhar, V. (2012). <i>Telecom Revolution in India: Technology, Regulation and Policy</i>. New Delhi, India: Oxford University Press, ISBN-13: 978-0-19-807553-0; ISBN-10: 0-19-807553-7.

Course Name	Information Management	
Course Branch	MSc (Digital Society)	
Course Proposer Name(s)	Prof. Chandrashekar Ramanathan	
Course Instructor Name(s)	Prof. Chandrashekar Ramanathan	
Course Type	Core	
Course Level	Level 1	
Credits (L:T:P) (Lecture : Tutorial : Practical)	2 credits	
Grading Scheme	(A,A-,B+,B,B-,C+,C,D,F)	
Pre-Requisites <i>(where applicable, specify exact course names)</i>		
None		
Course Description		
Information Management is an area of study that deals with different aspects dealing with digital information. The specific topics of relevance to this course are information modeling, information storage and retrieval. After they complete this course, the students should be able to pursue next level courses in the areas of software application development, data analysis, information architecture and so on.		
Course Outcomes		
At the end of this course, following are expected outcomes.		
The student is expected to UNDERSTAND:		
<ul style="list-style-type: none"> • role of information management in a digital society • how information gets stored in a computer • different types of data • concepts and differences between transaction processing and analytical processing • role of databases in enterprise software applications 		
The student is expected to KNOW:		
<ul style="list-style-type: none"> • how to model different types of data • different storage models for data • basic concepts of relational data model • overview of the elements of a large-scale information system • Data-driven decision making 		
The student is expected to DO:		
<ul style="list-style-type: none"> • implement information structures using tools like DBMS and spreadsheets • create information reports from existing data sources 		

Course Content
<p>Module 1: Introduction to Information Systems (3 hours)</p> <ul style="list-style-type: none"> • What is an information system • Different types of information systems • Components of an enterprise information system <p>Module 2: Data models (3 hours)</p> <ul style="list-style-type: none"> • Types of data • Role of data models in organizing and managing data • Relational data model <p>Module 3: Database Management Systems (3 hours)</p> <ul style="list-style-type: none"> • Introduction to computer storage architectures • Components of a DBMS <p>Module 4: Relational database design and implementation (6 hours)</p> <ul style="list-style-type: none"> • Conceptual modeling using ER and UML • Relational database design • Data processing with SQL • Case study of relational database design <p>Module 5: Information Reporting (3 hours)</p> <ul style="list-style-type: none"> • Types of reports • Report generation using reporting tools • Data visualization <p>Module 6: Overview of other information models (3 hours)</p> <ul style="list-style-type: none"> • Introduction to XML • Organizing information in spreadsheets • Introduction to Big Data
Assessments / Grading
<p>Suggested assessment criteria:</p> <ul style="list-style-type: none"> • Class tests --- 20% • Assignments --- 20% • Mini-project – 20 % • End-sem exam --- 40%
Text Book / References
<p>The following is the highly recommended standard textbook for Discrete mathematics (now Indian edition is also available):</p> <ul style="list-style-type: none"> • Discrete Mathematics and its Applications by Kenneth H Rosen, 7th Edition, McGraw Hill, 2014. <p>The following textbooks and study materials are recommended as additional reference:</p>

- Elements of Discrete Mathematics, by C. L. Liu, second edition 1985, McGraw-Hill Book Company. Reprinted 2000.
- Proper web notes (NPTEL notes by Prof. Kamala Krithivasan are available on discrete mathematics).
- Discrete Math for Computer Science Students by K. Bogart, S. Drysdale, C. Stein (freely available online).
- Discrete Mathematics by Laszlo Lovasz, Jozsef Pelikan, Katalin L. Vesztergombi, Springer 2003.