UNDERGRADUATE SUBJECTS

MAS.110 Fundamentals of Computational Media Design
Prereq: None
U (Fall)
3-3-6 HASS-A; CI-H
History of modern art and design from the perspective of the technologist. Exploration of visual analysis, typography, and technologies for audio/visual expression. Enrollment limited; preference to students in MAS freshman program. 
V. M. Bove, Jr.

MAS.111 Introduction to Doing Research in Media Arts and Sciences
Prereq: None
U (Spring)
1-4-1 [P/D/F]
Intended for students pursuing research projects at the Media Laboratory, particularly freshmen and sophomores. Exercises and discussions on topics including Media Lab research areas; documenting research progress; ethical issues in research; patents, copyrights, intellectual property; and giving oral, written, and online presentations of results. A final oral presentation is required. Enrollment limited; preference to students in the Media Arts and Sciences freshman program.
V. M. Bove, Jr.

MAS.131 Computational Camera and Photography
(Subject meets with MAS.531)
Prereq: Permission of instructor
U (Fall)
3-0-9
Covers the complete pipeline of computational cameras that attempt to digitally capture the essence of visual information by exploiting the synergistic combination of task-specific optics, illumination, sensors, and processing. Students discuss and use thermal, multi-spectral, high-speed and 3-D range-sensing cameras, as well as camera arrays. Presents opportunities in scientific and medical imaging, and mobile phone-based photography. Also covers cameras for human computer interaction (HCI) and sensors that mimic animal eyes. Intended for students with interest in algorithmic and technical aspects of imaging and photography. Students taking graduate version complete additional assignments. 
R. Raskar

MAS.132 Mathematical Methods in Imaging
(Subject meets with MAS.532)
Prereq: Permission of instructor
U (Spring)
2-0-7
Surveys the landscape of imaging techniques and develops skills for conducting imaging research. Reviews technical and social aspects of the evolving camera culture and considers its role in transforming social interactions, reshaping businesses, and influencing communities worldwide. Explores innovative protocols for sharing and consumption of visual media, as well as novel hardware and software tools based on advanced lenses, digital illumination, modern sensors, and emerging image-analysis algorithms. Students taking graduate version complete additional assignments.
R. Raskar

MAS.330J Design Across Scales, Disciplines and Problem Contexts
(Same subject as 4.110J)
(Subject meets with MAS.650)
Prereq: None
U (Spring)
2-2-8 HASS-A
See description under subject 4.110J.
N. Oxman, J. M. Yoon

MAS.490 Independent Study in Media Arts and Sciences
Prereq: Permission of instructor
U (Fall, Spring)
Units arranged
Can be repeated for credit

MAS.491 Independent Study in Media Arts and Sciences
Prereq: Permission of instructor
U (Fall, Spring)
Units arranged
Can be repeated for credit

MAS.UR Undergraduate Research in Media Arts and Sciences
Prereq: None
U (Fall, Spring, Summer)
Units arranged
Can be repeated for credit

GRADUATE SUBJECTS

MAS.500 Hands on Foundations in Media Technology
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged [P/D/F] H-LEVEL Grad Credit
A series of modular classes designed to provide basic foundations in the skills needed to perform research at the Media Lab. Introduces the technology tool sets and research techniques used broadly at the Media Lab. Students choose from a series of modules that include: hardware basics, I-O and interconnecting, design and fabrication, programming, analyzing data, machine learning, signals and systems, applied control, testing and evaluation methods, documentation and communication methods. Proportional credit will be assigned to each module successfully completed.
V. M. Bove, K. Larson, J. Paradiso

MAS.531 Computational Camera and Photography
(Subject meets with MAS.131)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Covers the complete pipeline of computational cameras that attempt to digitally capture the essence of visual information by exploiting the
synergistic combination of task-specific optics, illumination, sensors, and processing. Students discuss and use thermal, multi-spectral, high-speed and 3-D range-sensing cameras, as well as camera arrays. Presents opportunities in scientific and medical imaging, and mobile phone-based photography. Also covers cameras for human computer interaction (HCI) and sensors that mimic animal eyes. Intended for students with interest in algorithmic and technical aspects of imaging and photography. Students taking graduate version complete additional assignments.

R. Raskar

MAS.532 Mathematical Methods in Imaging
(Subject meets with MAS.132)
Prereq: Permission of instructor
G (Spring)
2-0-7

Surveys the landscape of imaging techniques and develops skills for conducting imaging research. Reviews technical and social aspects of the evolving camera culture and considers its role in transforming social interactions, reshaping businesses, and influencing communities worldwide. Explores innovative protocols for sharing and consumption of visual media, as well as novel hardware and software tools based on advanced lenses, digital illumination, modern sensors, and emerging image-analysis algorithms. Students taking graduate version complete additional assignments.

R. Raskar

MAS.533 Imaging Ventures: Cameras, Displays, and Visual Computing
Prereq: Permission of Instructor
G (Spring)
0-9-0 H-LEVEL Grad Credit

Project-oriented seminar covers the opportunities and challenges for businesses based on emergent imaging innovations. Students analyze the landscape of imaging developments, plan business strategies and brainstorm towards a start-up, business unit, non-profit or citizen sector organization; they are encouraged to form teams and craft a business plan to gain practical experience in imaging research. Includes case studies of established and emerging businesses, and talks by invited business speakers. Surveys commercialization and the innovation landscape in all imaging arenas. Topics include mobile camera phones, cameras in developing countries, image-search, medical imaging, online photo sharing, and computational photography. Enrollment limited.

R. Raskar

MAS.552J City Science
(Same subject as 4.557J)
Prereq: Permission of instructor
G (Fall, Spring)
3-0-9 H-LEVEL Grad Credit
Can be repeated for credit with permission of instructor

Focuses on architectural and mobility interventions that respond to changing patterns of living, working, and transport. Emphasizes mass-customized housing, autonomous parking, charging infrastructure, and shared-use networks of lightweight electric vehicles (LEVs). Students work in small teams and are lead by researchers from the Changing Places group. Projects focus on the application of these ideas to case study cities and may include travel. Invited guests from academia and industry participate.

K. Larson, R. Chin

MAS.580 Crafted By Nature: Bio-Inspired Digital Design and Fabrication
Prereq: Permission of instructor
Acad Year 2014–2015: Not offered
Acad Year 2015–2016: G (Fall)
3-6-3 H-LEVEL Grad Credit

Presents a foundation for understanding biologically inspired digital design and fabrication through an introduction to the theory and literature of biomimicry. Focuses on various material processes, such as weaving, folding and layering in micro- and macro-scales. Reviews the formal logic, mechanical behavior, and environmental impacts of a range of natural and synthetic materials, as well as ways by which to shape them, inherent to their physical properties. Through physical and digital form-finding exercises, explores the relationships between materials and their shaping processes in the generation of form. Students invent novel fabrication methods inspired by nature and reconsider the way things are designed and made in the 21st century. Intended for advanced students with an interest in bio-inspired design and some background in fabrication-based design. Competence in computational geometry and some command of parametric design software and basic programming desirable, as is general knowledge of CAD, CAM and CAE platforms. Enrollment limited; a short interest statement is required upon registration.

N. Oxman

MAS.581 Networks, Complexity, and Their Applications
Prereq: None
G (Spring)
2-0-10

Develops a conceptual understanding of the basic properties of networks and their implications. Networks are studied in the context of the empirical analysis of large systems and big data. Systems studied include technical systems, such as the internet and the world wide web, and socioeconomic systems, such as social networks and industry-location networks. Taught as a mixture of lectures and group projects. Limited to 25.

C. Hidalgo

MAS.600 Human 2.0
Prereq: Permission of instructor
G (Spring)
0-9-0 H-LEVEL Grad Credit

Covers principles underlying current and future technologies for cognitive, emotional and physical augmentation. Focuses on using anatomical, biomechanical, neuromechanical, biochemical and neurological models of the human body to guide the designs of augmentation technology for persons with either unusual or normal physiologies that wish to extend their cognitive, emotion, social or physical capability to new levels. Topics include robotic exoskeletons and powered orthoses, external limb prostheses, neural implant technology, social-emotional prostheses, and cognitive prostheses. Requires student presentations, critiques of class readings, and a final project including a publication-quality paper. Enrollment limited.

H. Herr

MAS.622J Pattern Recognition and Analysis
(Same subject as 1.126J)
Prereq: Permission of instructor
Acad Year 2014–2015: G (Fall)
Acad Year 2015–2016: Not offered
3-0-9 H-LEVEL Grad Credit

Fundamentals of characterizing and recognizing patterns and features of interest in numerical data. Basic tools and theory for signal understanding problems with applications to user modeling, affect recognition, speech recognition and understanding, computer vision, physiological analysis, and more. Decision theory, statistical classification, maximum likelihood and Bayesian estimation, nonparametric methods, unsupervised learning and clustering. Additional topics on machine and human learning from active research. Knowledge of probability theory and linear algebra required. Limited to 20.

R. W. Picard
MAS.630 Affective Computing
Prereq: Permission of instructor
Acad Year 2014–2015: Not offered
Acad Year 2015–2016: G (Fall)
2-0-10 H-LEVEL Grad Credit
Instructs students on how to develop technologies that help people measure and communicate emotion, that respectfully read and that intelligently respond to emotion, and have internal mechanisms inspired by the useful roles emotions play. Topics vary from year to year, and may include the interaction of emotion with cognition and perception; the communication of human emotion via face, voice, physiology, and behavior; construction of computers, agents, and robots having skills of emotional intelligence; the role of emotion in decision-making and learning; and affective technologies for education, autism, health, and market research applications. Weekly reading, discussion, and a term project required. Enrollment limited.
R. W. Picard

MAS.650 Design Across Scales, Disciplines and Problem Contexts
(Same subject as 4.110J, MAS.330J)
Prereq: None
G (Spring)
2-2-8
Explores the reciprocal relationships among design, science, and technology across scales. Covers a wide range of topics, from visualization, fabrication, computation, material ecology, interaction, and architecture to games and performance. Examines how transformations in science and technology have influenced design thinking and vice versa. Students collaborate on interdisciplinary design projects and creative opportunities. Additional work is required of students taking the graduate version of the subject.
N. Oxman, J. M. Yoon

MAS.664J Media Ventures
(Same subject as 15.376J, EC.731J)
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Seminar on founding, financing, and building entrepreneurial ventures in developing nations. Challenges students to craft enduring and economically viable solutions to the problems faced by these countries. Cases illustrate examples of both successful and failed businesses, and the difficulties in deploying and diffusing products and services through entrepreneurial action. Explores a range of established and emerging business models, as well as new business opportunities enabled by emerging technologies in MIT labs and beyond. Students develop a business plan executive summary suitable for submission in the MIT $100K Entrepreneurship Competition $1K Warm-Up.
A. Pentland, J. Bonsen

MAS.665J Development Ventures
Prereq: Permission of instructor
G (Fall)
3-0-9 H-LEVEL Grad Credit
Seminar surveys internal and external entrepreneurs, based on Media Lab technologies, to increase understanding of how digital innovations grow into societal change. Cases illustrate examples of both successful and failed businesses, as well as difficulties in deploying and diffusing products. Explores a range of business models and opportunities enabled by emerging Media Lab innovations. Students craft a business analysis for one of the featured technology innovations. Past analyses have become the basis for research publications, and new ventures. Particular focus on big data, mobile, and the use of personal data.
A. Pentland, J. Bonsen

MAS.690 Independent Study in Media Arts and Sciences
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for independent study under regular supervision by a faculty member. Registration subject to prior arrangement of subject matter and supervision by staff.
Staff

MAS.700 Future of News and Participatory Media
Prereq: Permission of instructor
G (Spring)
1-2-9 H-LEVEL Grad Credit
Studies the news as an engineering challenge in light of recent, rapid, and ongoing changes to the way news is delivered and spread. Consider how we discover what events are taking place in different parts of the world and how we explain the importance of these events to readers or viewers, as well as how readers of a story respond to events. Explores the systems journalists and others have used to report and share the news. Focuses on developing one’s own tools and methods to address these challenges through weekly reporting assignments and a final project in which students build tools for journalists (professional and otherwise) to use. Limited to 18.
E. Zuckerman

MAS.712 Learning Creative Learning
Prereq: Permission of instructor
Acad Year 2014–2015: Not offered
Acad Year 2015–2016: G (Spring)
3-0-9 [P/D/F] H-LEVEL Grad Credit
Can be repeated for credit
An introduction to ideas and strategies underlying the design of new learning technologies. Focuses especially on technologies that support interest-driven, project-based, collaborative learning experiences. Students analyze innovative learning technologies, discuss underlying educational ideas, examine design principles, create new prototypes and applications.
M. Resnick

MAS.731J The Society of Mind
(Same subject as 6.868J)
Prereq: Must have read “The Society of Mind” and “The Emotion Machine”; permission of instructor
G (Fall)
2-0-10 H-LEVEL Grad Credit
See description under subject 6.868J.
M. Minsky

MAS.750 Human-Robot Interaction
Prereq: Permission of instructor
G (Fall)
Not offered regularly; consult department
2-0-7 H-LEVEL Grad Credit
In-depth exploration of the leading research, design principles, and technical challenges in human-robot interaction (HRI), with an emphasis on socially interactive robots. Topics include mixed-initiative interaction, multi-modal interfaces, face-to-face communication, human-robot teamwork, social learning, aspects of social cognition, and long-term interaction. Applications of these topics to the development of personal robots for health, education, elder care, domestic assistance, and other domains will be surveyed. Requires student presentations, critiques of class readings, student projects, and a final project including a publication quality paper.
C. Breazeal

MAS.771 Autism Theory and Technology
Prereq: Permission of Instructor
Acad Year 2014–2015: G (Spring)
Acad Year 2015–2016: Not offered
2-0-10 H-LEVEL Grad Credit
Illuminates current theories about autism together with challenges faced by people on the autism spectrum. Theories in communicating, interacting socially, managing cognitive and affective overload, and achieving independent lifestyles are covered. In parallel, the course
MAS.790 Independent Study in Media Arts and Sciences
Prereq: Permission of instructor
G (Fall, Spring)
Units arranged H-LEVEL Grad Credit
Can be repeated for credit
Opportunity for independent study under regular supervision by a faculty member. Registration subject to prior arrangement of subject matter and supervision by staff.
T. Machover

MAS.826J Projects in Media and Music
(Same subject as 21M.581J)
Prereq: MAS.825J
G (Spring)
3-3-6 H-LEVEL Grad Credit
Can be repeated for credit with permission of instructor
Current computer music concepts and practice. Project-based work on research or production projects using the Media Lab’s computer music, interactive, and media resources. Requires significant studio work and a term project. Projects based on class interests and skills, and may be individually or group-based.
T. Machover

MAS.825J Musical Aesthetics and Media Technology
(Same subject as 21M.580J)
Prereq: Permission of instructor
G (Fall)
3-3-3 H-LEVEL Grad Credit
In-depth exploration of contemporary concepts in music and media. Studies recent music that uses advanced technology, and the artistic motivations and concerns implied by the new media. Practical experience with computer music technology, including MIDI and post-MIDI systems. Special emphasis on the interactive systems for professionals as well as amateurs. Midterm paper and term project required.
J. Paradiso

MAS.834 Tangible Interfaces
Prereq: Permission of instructor
G (Fall)
3-3-6 H-LEVEL Grad Credit
Explores design issues surrounding tangible user interfaces, a new form of human-computer interaction. Tangible user interfaces seek to realize seamless interfaces between humans, digital information, and the physical environment by giving physical form to digital information and computation, making bits directly manipulable with hands and perceptible at the periphery of human awareness. In the design studio environment, students explore experimental tangible interface designs, theories, applications, and underlying technologies, using concept sketches, posters, physical mockups, and working prototypes.
H. Ishii

MAS.863 Sensor Technologies for Interactive Environments
Prereq: Permission of instructor
G (Spring)
3-3-6 H-LEVEL Grad Credit
A broad introduction to a host of sensor technologies, illustrated by applications drawn from human-computer interfaces and ubiquitous computing. After extensively reviewing electronics for sensor signal conditioning, the lectures cover the principles and operation of a variety of sensor architectures and modalities, including pressure, strain, displacement, proximity, thermal, electric and magnetic field, optical, acoustic, RF, inertial, and bioelectric. Simple sensor processing algorithms and wired and wireless network standards are also discussed. Students are required to complete written assignments, a set of laboratories, and a final project.
J. Paradiso

MAS.864 The Nature of Mathematical Modeling
Prereq: Permission of instructor
G (Spring)
3-0-9 H-LEVEL Grad Credit
Surveys the range of levels of description useful for the mathematical description of real and virtual worlds, including analytical solutions and approximations for difference and differential equations; finite difference, finite element and cellular automata numerical models; and stochastic processes, nonlinear function fitting, constrained optimization, and data-driven inference. Emphasis on efficient practical implementation of these ideas.
N. Gershenfeld
MAS.881J Principles of Neuroengineering  
(Same subject as 9.422J, 20.452J)  
Prereq: Permission of instructor  
G (Fall)  
3-0-9 H-LEVEL Grad Credit  
Covers how to innovate technologies for brain analysis and engineering, for accelerating the basic understanding of the brain, and leading to new therapeutic insight and inventions. Focuses on using physical, chemical and biological principles to understand technology design criteria governing ability to observe and alter brain structure and function. Topics include optogenetics, noninvasive brain imaging and stimulation, nanotechnologies, stem cells and tissue engineering, and advanced molecular and structural imaging technologies. Design projects by students.  
E. S. Boyden, III

MAS.883J Neurotechnology Ventures  
(Same subject as 9.455J, 15.128J, 20.454J)  
Prereq: Permission of instructor  
G (Fall)  
2-0-7 H-LEVEL Grad Credit  
Special seminar focusing on envisioning, launching, and building start-ups that are commercializing innovations from neuroscience and neuroengineering. Topics include neuroimaging, diagnostics, motor rehabilitation, affective computing, novel scientific tools, and novel therapeutics including neuropharmaceuticals, neuromodulation, neuroprosthetics, regenerative medicine, and more. Each class is devoted to a specific topic area, often with invited speakers, exploring issues from the deeply technical through the market opportunity. Working in small groups students prepare a business plan executive summary for a new neurotechnology start-up.  
J. Bonsen, E. S. Boyden, R. Ellis-Behnke

MAS.890 Independent Study in Media Arts and Sciences  
Prereq: Permission of instructor  
G (Fall, Spring)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Opportunity for independent study under regular supervision by a faculty member. Registration subject to prior arrangement of subject matter and supervision by staff.  
Staff

General

MAS.910 Research in Media Technology  
Prereq: Permission of instructor  
G (Fall, Spring, Summer)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
For research assistants in Media Arts and Sciences, where the assigned research is approved for academic credit by the department.  
Staff

MAS.912 Teaching in Media Arts and Sciences  
Prereq: None  
G (Fall, Spring)  
Units arranged [P/D/F]  
Can be repeated for credit  
Laboratory, tutorial, or classroom teaching under the supervision of a Media Arts and Sciences faculty member. Students selected by interview. Enrollment limited by availability of suitable teaching assignments.  
Staff

MAS.921 Proseminar in Media Arts and Sciences  
Prereq: Permission of instructor  
G (Fall)  
3-0-9 [P/D/F] H-LEVEL Grad Credit  
Designed specifically for new doctoral students in the Media Arts and Sciences (MAS) program. Explores intellectual foundations of MAS, unifying themes connecting MAS research, and working practices of MAS researchers. Restricted to MAS doctoral students.  
D. Roy

MAS.940 Preparation for SM Thesis  
Prereq: Permission of instructor  
G (Fall, IAP, Spring, Summer)  
2-0-10 [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Selection of thesis topic, definition of method of approach, and preparation of thesis proposal. Independent study supplemented by individual conferences with faculty. In some cases, coregistration with 21W.793 or equivalent required.  
S. Kamvar, C. Schmandt

MAS.945 Media Arts and Sciences General Exam  
Prereq: Permission of instructor  
G (Fall, IAP, Spring, Summer)  
0-12-0 [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Selected readings for Media Arts and Sciences doctoral students in preparation for their qualifying exams.  
Staff

MAS.950 Preparation for PhD Thesis  
Prereq: Permission of instructor  
G (Fall, Spring, Summer)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Selects thesis subject, defines method of approach, and prepares preliminary thesis outline. Independent study, supplemented by frequent individual conferences with staff members. Restricted to doctoral candidates.  
Staff

MAS.S60–MAS.S64 Special Subject in Media Technology  
Prereq: Permission of instructor  
G (Fall, IAP, Spring)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Supplementary work in areas not covered by the regular curriculum. Registration subject to prior arrangement.  
Staff

MAS.S65–MAS.S69 Special Subject in Media Technology  
Prereq: Permission of instructor  
G (Fall, IAP, Spring)  
Units arranged [P/D/F] H-LEVEL Grad Credit  
Can be repeated for credit  
Supplementary work in areas not covered by the regular curriculum. Registration subject to prior arrangement.  
Staff

MAS.THG Graduate Thesis  
Prereq: Permission of instructor  
G (Fall, IAP, Spring, Summer)  
Units arranged H-LEVEL Grad Credit  
Can be repeated for credit  
Program of research and writing of thesis; to be arranged by the student with supervising committee.  
Staff