

Extended Realities, MS

Overview

The Master of Science in Extended Realities seeks to open the new technologies, methods, practices, and skills of extended realities (XR) to students. XR includes augmented, virtual, and mixed reality. XR technologies have seen explosive growth over the last decade of mixed reality.

This program is structured to allow students flexibility and specialization to choose a path that matches their interest. Students have the opportunity to focus on a single concentration area or a mix of course electives depending upon their professional background and aspirations. The College of Arts, Media and Design partners closely with Bouvé College of Health Sciences, the College of Engineering, the D'Amore McKim School of Business, and Khoury College of Computer Sciences to offer additional concentrations that provide breadth and depth of knowledge.

The Master of Science in Extended Realities welcomes students from a diverse range of backgrounds because of the applications of XR technology used in many disciplines and industries, including medicine, business, entertainment, architecture, and journalism.

Some concentrations may require a technical background and are noted in the requirements.

Program Requirements

Complete all courses and requirements listed below unless otherwise indicated.

Extended Reality Core

Code	Title	Hours
Required Courses		
EXRE 5010 and EXRE 5011	Immersive Media: Extended Realities (XR) History, Theory, and Impact and Seminar for EXRE 5010	5
EXRE 5020	Developing Extended Realities (XR)	4
EXRE 5030	Designing Extended Realities (XR)	4
EXRE 6500	Extended Realities (XR) Studio	4
EXRE 7500 or EXRE 7990	Extended Realities (XR) Project Thesis	4
GSND 5122	Business Models in the Game Industry	1

Extended Reality Concentration Options

Complete one of the following options:

- Artificial Intelligence (p. 2)
- Data Visualization (p. 2)
- Entrepreneurship (p. 2)
- Experience Design (p. 2)
- Game Design (p. 2)
- Game Science (p. 3)
- Human Computer Interaction (p. 3)
- Human Movement Science (p. 3)
- Information Ethics (p. 3)
- Marketing (p. 4)
- Media Innovation and Advocacy (p. 4)
- Public History (p. 4)
- Wireless Networking (p. 4)
- XR Design (p. 5)
- XR Development (p. 5)

Program Credit/GPA Requirements

34 total semester hours required. Some concentrations may require more than 34 semester hours to complete.

Minimum 3.000 GPA required

ARTIFICIAL INTELLIGENCE CONCENTRATION

Code	Title	Hours
Requires a background in computer science.		
Complete three of the following:		12
CS 5097	Mixed Reality	
CS 5100	Foundations of Artificial Intelligence	
CS 6120	Natural Language Processing	
CS 6140	Machine Learning	

DATA VISUALIZATION CONCENTRATION

Code	Title	Hours
Required Courses		
ARTG 5150 and ARTG 5151	Information Visualization Principles and Practices and Information Design Critique Seminar	4
ARTG 5330	Visualization Technologies 1: Fundamentals	4
Electives		
Complete 4 semester hours from the following:		4
ARTG 5310	Visual Cognition	
ARTG 6110	Information Design Theory and Critical Thinking	
ARTG 6330	Information Design Mapping Strategies	

ENTREPRENEURSHIP CONCENTRATION

Code	Title	Hours
Required Courses		
INNO 6200	Enterprise Growth and Innovation	3
Electives		
Complete 9 semester hours from the following:		9
ENR 6210	Managing Operations in Early Stage Ventures	
ENR 6212	Business Planning for New Ventures	
ENR 6214	Social Enterprise	
ENR 6218	Business Model Design and Innovation	
ENR 6240	Emerging and Disruptive Technologies	
ENR 6241	Entrepreneurial Marketing and Selling	
ENR 6250	Lean Design and Development	
ENR 6300	Managing a Technology-Based Business	
GE 5030	Iterative Product Prototyping for Engineers	
INNO 6230	Platform Innovation	
MKTG 6214	New Product Development	

EXPERIENCE DESIGN CONCENTRATION

Code	Title	Hours
Required Courses		
ARTG 5610	Design Systems	4
ARTG 6310	Design for Behavior and Experience	4
Electives		
Complete 4 semester hours from the following:		4
ARTG 5600	Experience Design Studio 1: Principles	
ARTG 5620	Notational Systems for Experience	
ARTG 5640	Prototyping for Experience Design	

GAME DESIGN CONCENTRATION

Code	Title	Hours
Required Courses		
GSND 5110 and GSND 5111 and GSND 5112	Game Design and Analysis and Seminar for GSND 5110 and Recitation for GSND 5110	5
Electives		

Complete 8 semester hours from the following:	8
GSND 6000	Advanced Topics in Game Design
GSND 6240	Exploratory Concept Design
GSND 6250	Spatial and Temporal Design

GAME SCIENCE CONCENTRATION

Code	Title	Hours
Required Courses		
GSND 5110 and GSND 5111 and GSND 5112	Game Design and Analysis and Seminar for GSND 5110 and Recitation for GSND 5110	5

Electives

Complete at least 8 semester hours from the following:	8
GSND 6001	Advanced Topics in Game Science
GSND 6330 and GSND 6331	Player Experience and Recitation for GSND 6330
GSND 6340	Biometrics for Design
GSND 6350	Data-Driven Player Modeling

HUMAN COMPUTER INTERACTION CONCENTRATION

Code	Title	Hours
Required Courses		
CS 5340	Computer/Human Interaction	4

Electives

Complete 8 semester hours from the following:	8
ARTG 5710	Design for Dignity
CS 5097	Mixed Reality
CS 5170	Artificial Intelligence for Human-Computer Interaction
CS 6350	Empirical Research Methods
CS 7390	Special Topics in Human-Centered Computing
GSND 6340	Biometrics for Design

HUMAN MOVEMENT SCIENCE CONCENTRATION

Code	Title	Hours
Required Courses		
PT 7001	Core Concepts in Rehabilitation Science and Research	3
PT 7005	Experimental Design and Applied Statistics	4

Electives

Complete 7–8 semester hours from the following:	7-8
PT 5133	Kinesiology
PT 5150	Motor Control, Development, and Learning
PT 5321	Applications of Biomechanics in Human Function and Movement
PT 5410	Functional Human Neuroanatomy
PT 7010	Measurement and Analysis of Human Movement and Bioinstrumentation
PT 7020	Technologies in Movement and Rehabilitation Science

INFORMATION ETHICS CONCENTRATION

Code	Title	Hours
Required Courses		
Complete two of the following:	8	
CY 5240	Cyberlaw: Privacy, Ethics, and Digital Rights	
PHIL 5005	Information Ethics	
PHIL 5010	AI Ethics	

Elective

Complete one of the following:	4
PHIL 5001	Global Justice

PHIL 5005	Information Ethics	
PHIL 5010	AI Ethics	

MARKETING CONCENTRATION

Code	Title	Hours
Required Courses		
MKTG 6200	Creating and Sustaining Customer Markets	3
Electives		
Complete 9 semester hours from the following:		9
MKTG 6210	Marketing Research	
MKTG 6212	International Marketing	
MKTG 6214	New Product Development	
MKTG 6216	Market Focused Strategy	
MKTG 6218	Managing Customer Engagement in a Service World	
MKTG 6222	Digital Marketing	
MKTG 6223	Brand and Advertising Management	
MKTG 6224	B2B and Strategic Sales	
MKTG 6226	Consumer Behavior	
MKTG 6230	Driving Marketing Performance: Measure, Analyze, Profit	
MKTG 6234	Marketing Analytics	

MEDIA INNOVATION AND ADVOCACY CONCENTRATION

Code	Title	Hours
Required Courses		
JRNL 5400	Media and Advocacy in Theory and Practice	4
JRNL 6340	Fundamentals of Digital Journalism	4
Elective		
Complete one of the following:		4-5
ARTG 5150 and ARTG 5151	Information Visualization Principles and Practices and Information Design Critique Seminar	
JRNL 5311	Design for Storytelling	
JRNL 6305	Topics (and optional ARTG 5151)	
JRNL 6341	Telling Your Story with Data	

PUBLIC HISTORY CONCENTRATION

Code	Title	Hours
Required Courses		
HIST 5237	Issues and Methods in Public History	4
Complete the following (repeatable) course twice:		4
HIST 8410	Fieldwork in History 1 (to be taken twice)	
Elective		
Complete one of the following:		4
HIST 5241	Exhibits and Museums	
HIST 7219	Topics in Cultural History	
HIST 7250	Topics in Public History	

WIRELESS NETWORKING CONCENTRATION

Code	Title	Hours
Required Courses		
EECE 7374	Fundamentals of Computer Networks	4
Electives		
Complete 8 semester hours from the following:		8
EECE 5155	Wireless Sensor Networks and the Internet of Things	
EECE 5576	Wireless Communication Systems	
EECE 7364	Mobile and Wireless Networking	

XR DESIGN CONCENTRATION

Code	Title	Hours
Required Courses		
GSND 6520	3D Modeling and Asset Creation Principles	4
Electives		
Complete at least 8 semester hours from the following:		8-9
ARTG 5150 and ARTG 5151	Information Visualization Principles and Practices and Information Design Critique Seminar	
ARTG 5310	Visual Cognition	
ARTG 5610	Design Systems	
ARTG 6310	Design for Behavior and Experience	
EXRE 5973	Topics in Extended Realities (XR)	
GSND 5110 and GSND 5111 and GSND 5112	Game Design and Analysis and Seminar for GSND 5110 and Recitation for GSND 5110	
GSND 6250	Spatial and Temporal Design	
GSND 6330	Player Experience	
GSND 6340	Biometrics for Design	
GSND 6460	Generative Game Design	
JRNL 6340	Fundamentals of Digital Journalism	

XR DEVELOPMENT CONCENTRATION

Code	Title	Hours
Required Courses		
CS 5097	Mixed Reality	4
Electives		
Complete 8 semester hours from the following:		8
CS 5150	Game Artificial Intelligence	
CS 5170	Artificial Intelligence for Human-Computer Interaction	
CS 5310	Computer Graphics	
CS 5335	Robotic Science and Systems	
CS 5340	Computer/Human Interaction	
CS 5850	Building Game Engines	
CS 6140	Machine Learning	

Plan of Study**Sample Plan of Study**

Year 1				
Fall	Hours	Spring	Hours	
EXRE 5010 and EXRE 5011		5 EXRE 5030		4
EXRE 5020		4 GSND 5110 and GSND 5111 and GSND 5112		5
		9		9
Year 2				
Fall	Hours	Spring	Hours	
EXRE 6500		4 EXRE 7500		4
GSND 5122		1 GSND 6350		4
GSND 6340		4		
		9		8
Total Hours: 35				