**Course Proposal:** Augmented Reality and Virtual Reality Systems

**Course Overview:** This course provides an in-depth exploration of Augmented Reality (AR) and Virtual Reality (VR) systems, targeted at senior-level undergraduate and graduate students in the fields of Electrical Engineering and Computer Engineering. The course delves into the theoretical foundations, technical aspects, design principles, and practical applications of AR/VR systems, equipping students with the knowledge and skills necessary to understand, develop, and innovate in this rapidly evolving field.

**Course Objectives:** By the end of this course, students will be able to:

* **Understand AR/VR Concepts:** Demonstrate a comprehensive understanding of the fundamental concepts, theories, and terminology related to AR/VR systems.
* **Analyze AR/VR Systems:** Critically analyze the components, architecture, and technologies underlying AR/VR systems.
* **Design and Implement AR/VR Applications:** Design, develop, and implement interactive AR/VR applications using appropriate software and hardware tools.
* **Explore Advanced Topics:** Investigate advanced topics such as spatial computing, haptic feedback, and multi-sensory integration for AR/VR.

**Course Outline:**

**Module 1: Introduction to AR/VR Systems**

* Historical context and evolution of AR/VR
* Core principles and differences between AR and VR
* Application domains and emerging trends

**Module 2: Software Development for AR/VR**

* Programming environments: Unity3D, Unreal Engine
* Scripting languages: C# (focus on Unity)
* 3D asset creation and optimization

**Module 3: Principles of AR/VR Tracking and Sensing**

* Pose estimation and camera calibration
* Simultaneous Localization and Mapping (SLAM)
* Sensor fusion for accurate tracking

**Module 4: System Frameworks for AR/VR**

* System architecture and components
* Real-time constraints and performance optimization
* Multi-threading and synchronization techniques

**Module 5: Interaction Methods in AR/VR**

* Controllers and gesture recognition
* Hand tracking and gesture-based interaction
* Voice commands and natural user interfaces

**Module 6: Display Technologies in AR/VR**

* Head-mounted displays and optics
* Waveguides
* Lenses
* Field of view, resolution, and frame rates

**Module 7: Audio Technologies for Immersive Experiences**

* Spatial audio principles and techniques
* Binaural rendering and 3D audio
* Audio interactions in AR/VR environments

**Module 8: User Experience and Human Interaction**

* Cognitive aspects of AR/VR: perception, attention, presence
* Usability evaluation methods
* Designing for comfort and reducing motion sickness

**Module 9: Haptic Feedback and Tactile Interfaces**

* Haptic feedback principles and technologies
* Tactile interfaces and force feedback devices
* Integrating haptics into AR/VR systems

**Assessment:**

* Quizzes and exams assessing theoretical knowledge
* Programming assignments to develop practical skills

**Prerequisites:**

* Proficiency in programming (Java, C++, or C#)
* Basic understanding of computer graphics concepts
* Familiarity with linear algebra and calculus

**Conclusion:** The Augmented Reality and Virtual Reality Systems course offers students a comprehensive understanding of the theoretical underpinnings, technical aspects, design considerations, and practical applications of AR/VR technology. Through hands-on projects and discussions of emerging trends, students will be well-equipped to contribute to the development and advancement of immersive experiences in various domains. This course is designed to prepare both undergraduate and graduate students for careers at the forefront of AR/VR innovation.