OPEN ELECTIVE OTHER THAN PARTICULAR PROGRAM (OE)

Industry orientatedOpen ElectivE : ARVR

Government College of Engineering, Karad

Second Year (Sem – III) B. Tech. Information Technology

IOE3331:Open Elective I AR/VRApplication Development

Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	03		Duration of ESE	As applicable

Prerequisite : Mathematics, Programming for problem solving/Computer fundamentals

Course Outcomes (CO): Students will be able to

CO1	Recall fundamentals and real-time 3D content creation basics& scripting.
CO2	Understand software interface and tools for scene creation and optimization.
CO3	Apply 3D modeling, animation, and physics in 3d design tool.
CO4	Analyze and optimize audio, visual effects using hardware and performance in software.

	Course Contents	**CO**	**Hours**
Unit 1	**Introduction to Real-time 3D Content & Unity Game Engine:** Understanding 3D content creation: The concept of real-time rendering, comparison with offline rendering, and the importance of optimization, Exploring different game engines features and capabilities, Unity components and its features.	**CO1**	**(05)**
Unit 2	**Fundamentals of Unity Game Engine:** Exploring Unity's interface and tools: Scene view, Game view, Hierarchy, Project, and Inspector windows, various tools Transform, Creating and organising scenes and objects in Unity from scratch, importing 3D models, textures, audio files, and other resources into Unity, and optimizing them for use in the project.	**CO2**	**(07)**
Unit 3	**3D Modelling, Animation, and Physics:** Basics of 3D modelling concepts, tools, and techniques. Animating objects and characters: Understanding key frame animation, skeletal animation, and animation blending. Creating animations. Introduction to Unity's physics engine and components like Rigid body, Collider, and Physics materials. Implementing basic physics interactions.	**CO3**	**(06)**
Unit 4	**User Interface Design & Application Scripting:** Principles of UI/UX design, creating UI elements using Unity's UI system (Canvas, Image, Text, Button, etc.), Basics of C# programming language, syntax, variables, data types, control structures, functions, and classes. Writing scripts for various applications, UI interactions, and coding to reinforce learning.	**CO1**	**(08)**
Unit 5	**Audio, Visual Effects, and Optimization:** Adding and managing audio assets, implementing sound effects, background music, and spatial audio. Incorporating visual effects for enhanced immersion (VFX Graph) creating particle effects, shaders, post-processing effects, and other visual enhancements. Techniques for optimizing performance in Unity projects, LOD (Level of Detail), batching, occlusion culling, and more.	**CO4**	**(06)**
Unit 6	**Augmented Reality & Virtual Reality Development:** Understanding AR and VR: hardware, setting up AR sessions. Detecting and tracking surfaces, placing virtual objects in the real world, and interactions. Developing a VR experience for the Meta Quest platform, configuring Unity for Oculus development, implementing VR interactions (grabbing, teleportation), optimizing the VR experience for performance.	**CO4**	**(07)**

Text Books

1.	Mastering Unity 2D Game Development - Second Edition,AshleyGodbold, Simon Jackson, Packt Publishing, October 2016, ISBN: 9781786463456
2.	Zeynep Tacgin, “Virtual and Augmented Reality: An Educational Handbook”, Cambridge Scholars Publisher, 2020
3	Joe Hocking, Unity in Action: Multiplatform Game Development in C# with Unity, Manning Publications, 2018
4	Alan Craig, William Sherman and Jeffrey Will, “Developing Virtual Reality Applications, Foundations of Effective Design”, Morgan Kaufmann, 2009

Reference Books

1.	Steven M. LaValle, “Virtual Reality”, Cambridge University Press, 2016
2.	John Vince, “Virtual Reality Systems”, Pearson Education Asia, 2007.
3.	Joe Hocking Unity in Action: Multiplatform Game Development in C# with Unity 5

Useful Links			
1.	https://stanford.edu/class/ee267/syllabus.html Prof. Ivan Sutherland, Standford University		
2.	https://nptel.ac.in/courses/106/106/106106138/ Prof. Steve Lavalle,IIT Madras.		
3.	https://nptel.ac.in/courses/121/106/121106013/ Prof. Dr. M. Manivannan,IIT Madras.		

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	-	1	-	-	-	-	-	-	1
CO 2	2	3	2	2	2	-	-	-	-	-	-	1
CO 3	3	3	3	2	3	1	-	-	1	-	1	2
CO 4	2	2	3	3	3	1	1	-	2	1	-	3

: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern(with revised Bloom’s Taxonomy)

Knowledge Level	ISE	ESE
Remember	10	10
Understand	10	10
Apply	10	10
Analyse	10	10
Evaluate	10	10
Create	-	-
TOTAL	50	50

Government College of Engineering, Karad				
Second Year (Sem – III) B. Tech. Information Technology				
IOE3332: Open Elective -01 Lab- AR/VR Application Development Lab				
Laboratory Scheme:			**Examination Scheme:**	
Practical	02 Hrs/week		ISE	25
Total Credits	01		ESE	25

Prerequisite : Mathematics, Programming for problem solving

Course Outcomes (CO): Students will be able to

CO1	Apply real-time 3D scene creation with basic physics interactions.
CO2	Design user interfaces utilizing UI system for game or application prototypes.
CO3	Develop and test C# scripts to control game behaviour and player interactions.
CO4	Integrate audio-visual effects and optimize performance.

Course Contents		**CO**
Implementation of following concepts		
Experiment 1	Create a real-time 3D scene in Unity incorporating basic physics interactions.	**CO1**
Experiment 2	Design and implement a user interface for a game or application prototype using Unity's UI system.	**CO2**
Experiment 3	Write and test scripts in C# to control game behavior, such as player movement and object interactions.	**CO3**
Experiment 4	Integrate audio effects and visual enhancements into a Unity project to enhance immersion. e. Optimize a Unity project for performance on different platforms, focusing on techniques like LOD, batching, and occlusion culling.	**CO4**
Experiment 5	Experiment with augmented reality using Unity's AR Foundation package to develop basic AR interactions.	**CO1**
Experiment 6	Develop a VR experience for the Meta Quest platform, implementing VR interactions like grabbing and teleportation.	**CO1**
Experiment 7	Develop a simple web-based mini-game using Unity WebGL, incorporating basic gameplay mechanics and visual effects.	**CO1**
Experiment 8	Create an AR sample app for Android devices using Unity and AR Foundation.	**CO2**
Experiment 9	Implement AR features such as plane detection, object placement, and basic interactions like tapping to spawn virtual objects.	**CO3**
Experiment 10	Develop a VR sample app for the Meta Quest platform using Unity and Oculus integration.	**CO4**
Experiment 11	Design immersive VR environments and implement VR interactions using Oculus controllers.	**CO4**
Experiment 12	Optimize the VR experience for smooth performance on the Meta Quest headset, considering factors like frame rate and rendering quality	**CO4**

List of Submission:

Minimum number of Experiments : 10

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	2	3	1	1	2	-	-	1	2
CO 2	2	1	3	2	3	2	2	1	2	2	2	2
CO 3	3	2	3	2	3	-	1	2	1	2	3	2
CO 4	2	3	2	3	3	2	2	-	2	2	1	2

1: Slight(Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	5	5	5	5	5	5	5	5	5	5	5
Task II	10	10	10	10	10	10	10	10	10	10	10
Task III	10	10	10	10	10	10	10	10	10	10	10
ISE	25	25	25	25	25	25	25	25	25	25	25

Government College of Engineering, Karad

Second Year (Sem – IV) B. Tech. Information Technology

IOE3433:Open Elective II Fundamentals of Real-time Rendering

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	02		Duration of ESE	As applicable

Prerequisite : AR/VR Application Development

Course Outcomes (CO): Students will be able to

CO1	Understand virtual production techniques' historical evolution and applications.
CO2	Apply green screen technology effectively for virtual production setups.
CO3	Utilize Game Engine proficiently in virtual production.
CO4	Implement real-time rendering techniques for high-quality visuals in virtual environment

	Course Contents	CO	Hours
Unit 1	**Introduction to Virtual Production:** Historical overview and evolution of virtual production techniques. Applications and benefits of virtual production in film, television, and other media industries..	**CO1**	**(03)**
Unit 2	**Fundamentals of Green Studio:** Exploring Green Screen Studios, exploring green screen technology and its significance in virtual production. Setup and operation of green screen studios and Lighting techniques.	**CO2**	**(04)**
Unit 3	**Unity for Virtual Production:** Overview of Unity Game Engine and its role in virtual production. Importing assets and setting up virtual environments in Unity for production purposes.	**CO3**	**(04)**
Unit 4	**Real-time Rendering & Visualisation:** Real-time Rendering and Visualization, basics and its importance in virtual production, Techniques for achieving realistic visuals in real-time environments. Utilizing Unity's rendering capabilities for high-quality visual output.	**CO4**	**(06)**
Unit 5	**Virtual Design:** Virtual Set Design principles and layout., Designing immersive virtual environments for different production needs., Incorporating props, set dressing, and lighting to enhance realism and aesthetics..	**CO1 & CO4**	**(06)**
Unit 6	**Virtual Camera system and Scene composition:** Virtual Camera Systems and their role in virtual production, Types of virtual cameras and their functionalities. Operating virtual cameras within Unity for scene composition and framing.	**CO2 & CO3**	**(06)**

Text Books

1.	**Tomas Akenine-Möller, Eric Haines, and Naty Hoffman**, *Real-Time Rendering, Fourth Edition*, A K Peters/CRC Press, 2018
2.	**Noah Kadner**, *The Virtual Production Field Guide*, Epic Games, 2020
3.	**Jeremy Hanke and Michele Yamazaki**, *Green Screen Made Easy: Keying and Compositing Techniques for Indie Filmmakers*, Michael Wiese Productions, 2017
4	***Jeff Foster***, *The Green Screen Handbook: Real-World Production Techniques, Sybex, 2014*

Reference Books

1.	**Joe Hocking**, *Unity in Action: Multiplatform Game Development in C# with Unity*, Manning Publications, 2018
2.	**Blain Brown**, *Cinematography: Theory and Practice: Image Making for Cinematographers and Directors*, Routledge, 2016
3.	**Laura Frank**, *Real-Time Video Content for Virtual Production & Live EntertainmentA Learning Roadmap for an Evolving Practice*, Routledge, 2023

Useful Links

1.	https://www.udemy.com/course/unitycourse/
2.	https://archive.nptel.ac.in/courses/121/106/121106013/
3.	https://unity.com/resources
4.	https://www.classcentral.com/classroom/youtube-learn-unity-multiplayer-free-complete-course-netcode-for-game-objects-unity-tutorial-2023-135735

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	1	1	2	2	-	-	-	-	-	2
CO 2	2	2	2	2	3	2	-	-	-	1	-	2
CO 3	3	2	3	2	3	2	2	2	1	1	1	3
CO 4	2	3	2	3	3	2	1	-	-	2	1	3

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern

Knowledge Level	ISE	ESE
Remember	5	5
Understand	10	10
Apply	10	10
Analyse	15	15
Evaluate	10	10
Create	-	-
TOTAL	50	50

Government College of Engineering, Karad

Third Year (Sem – V) B. Tech. Information Technology

IOE3534:Open Elective III Game Development with Unreal Engine

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	02		Duration of ESE	As applicable

Prerequisite : Fundamentals of Real-time Rendering

Course Outcomes (CO): Students will be able to

CO1	Understand the basics of game development Engine, including interface navigation and asset management.
CO2	Apply advanced gameplay mechanics, such as controls, movement, animation, and interactivity.
CO3	Analyze and implement visual effects, audio assets, and concepts in game development engine.
CO4	Evaluate and optimize game performance, preparing projects for distribution across platforms in Unreal Engine

	Course Contents	CO	Hours
Unit 1	**Introduction to Unreal Engine:** Introduction to Unreal Engine: Overview of Unreal Engine and its interface, Installation and setup, Basics of game assets and importing.	**CO1**	**(04)**
Unit 2	**Fundamentals of Game development:** Game Development Fundamentals, Level design and environment creation, Introduction to Blueprint visual scripting, Implementing basic gameplay mechanics.	**CO2**	**(05)**
Unit 3	**Gameplay and Blending:** Advanced Gameplay Mechanics, Player controls and character movement, Animation blending and state machines, Adding interactive elements and game mechanics.	**CO2**	**(05)**
Unit 4	**Virtual effects:** Audio, and Multiplayer, incorporating visual effects and particle systems, integrating audio assets for sound effects and music, Introduction to networking and multiplayer concepts.	**CO3**	**(05)**
Unit 5	**Optimization and performance enhancement:** Techniques for optimizing game performance, profiling tools and performance monitoring, Best practices for improving frame rate and reducing memory usage..	**CO4**	**(05)**
Unit 6	**Packaging and Distribution:** Packaging and Distribution, Preparing the game for distribution, Building and packaging for different platforms, Showcase and presentation of completed projects.	**CO4**	**(05)**

Text Books

1. Joanna Lee - "Learning Unreal Engine Game Development" - Packt Publishing - 2016
2. Tracy Fullerton - "Game Design Workshop: A Playcentric Approach to Creating Innovative Games" - A K Peters/CRC Press - 2014
3. Scott Rogers - "Level Up! The Guide to Great Video Game Design" - Wiley - 2014

Reference Books

1. Joshua Glazer - "Multiplayer Game Programming: Architecting Networked Games" - Addison-Wesley Professional - 2015
2. Jesse Schell - "The Art of Game Design: A Book of Lenses" - CRC Press - 2008
3. Jason Gregory - "Game Engine Architecture" - CRC Press - 2018

Useful Links

1. https://www.udemy.com/course/unrealcourse/
   https://archive.nptel.ac.in/courses/121/106/121106013/
2. https://www.udemy.com/course/unreal-engine-5-the-complete-beginners-course/
3. https://www.coursera.org/specializations/cplusplusunrealgamedevelopment

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	2	1	3	-	-	-	-	-	-	1
CO 2	2	2	3	2	3	1	-	-	-	-	-	2
CO 3	3	3	3	3	3	2	1	2	1	-	-	1
CO 4	2	2	2	2	2	1	1	2	1	1	1	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember		
Understand	10	10
Apply	10	10
Analyse	15	15
Evaluate	15	15
Create	-	-
TOTAL	50	50