



Specialization/Minor in Augmented Reality and Vertual Reality

EFFECTIVE FOR 2021-22 BATCH

2ND YEAR TO 4TH YEAR

Eligible Branches to adopt as Specialization

- 1. B.Tech.- Computer Science & Engineering**
- 2. B.Tech.- Electronics Engineering**



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Evaluation Schemes for Specializations/Minor in B.Tech

Specialization in Augmented and Virtual reality										
S.N	Code	Sem	Subject	Periods			Evaluation Scheme		Total Marks	Credits
				L	T	P	Internal	External		
1.	SAR301	3 rd	Virtual reality designing	3	0	0	50	100	150	3
2.	SAR401	4 th	Augmented & virtual reality	3	0	0	50	100	150	3
3.	SAR501	5 th	Concepts of digital manufacturing	3	0	0	50	100	150	3
4.	SAR601	6 th	Virtual reality systems	3	0	0	50	100	150	3
5.	SAR701	7 th	Computer graphics for virtual reality	3	0	0	50	100	150	3
6.	SAR801	8 th	Modeling and simulation of virtual systems	3	0	0	50	100	150	3
Total				18	0	0	300	600	900	18



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SAR301	VIRTUAL REALITY DESIGNING	L	T	P	C
		3	0	0	3

Contents		Hours
Unit 1	ADVANCES IN 3D USER INTERFACES: 3D User Interfaces for the Real World, AR Interfaces as 3D Data Browsers, 3D Augmented Reality Interfaces, Augmented Surfaces and Tangible Interfaces, Agents in AR, Transitional AR-VR Interfaces - The future of 3D User Interfaces, Questions of 3D UI Technology, 3D Interaction Techniques, 3D UI Design and Development, 3D UI Evaluation and Other Issues.	8
Unit 2	VIRTUAL REALITY APPLICATIONS: Engineering, Architecture, Education, Medicine, Entertainment, Science, Training.	8
Unit 3	SOFTWARE TECHNOLOGIES: Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occluders, Lights and Cameras, Scripts, Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring and Playback, VR toolkits, Available software in the market.	8
Unit 4	3D INTERACTION TECHNIQUES: 3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Design Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Wayfinding, User Centered Wayfinding Support, Environment Centered Wayfinding Support, Evaluating Wayfinding Aids	8
Unit 5	Design Guidelines - System Control, Classification, Graphical Menus, Voice Commands, Gestural Commands, Tools, Multimodal System Control Techniques, Design Guidelines, Case Study: Mixing System Control Methods, Symbolic Input Tasks, symbolic Input Techniques, Design Guidelines, Beyond Text and Number entry.	8

Suggested Readings :

1. **Complete Virtual Reality and Augmented Reality Development with Unity**
By Jesse Glover, Jonathan Linowes
2. **Augmented Reality and Virtual Reality: The Power of AR and VR for Business**
by M. Claudia tom Dieck, Timothy Jung
3. **Practical Augmented Reality: A Guide to the Technologies, Applications**
By Steve Aukstakalnis



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SAR401	AUGMENTED & VIRTUAL REALITY	L	T	P	C
		3	0	0	3

Contents		Hours
Unit 1	Introduction of Virtual Reality: Fundamental Concept and Components of Virtual Reality, Primary Features and Present Development on Virtual Reality, Multiple Modals of Input and Output Interface in Virtual Reality: Input -Tracker, Sensor,Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual / Auditory / Haptic Devices	8
Unit 2	Visual Computation in Virtual Reality: Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering	8
Unit 3	Environment Modeling in Virtual Reality: Geometric Modeling, Behavior Simulation,Physically Based Simulation, Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus, ObjectGrasp	8
Unit 4	Introduction of Augmented Reality (AR): System Structure of Augmented Reality. Key Technology in AR, Development Tools and Frameworks in Virtual Reality: Frameworks of Software, Development Tools in VR. X3D Standard; Vega, MultiGen, Virtools etc.	8
Unit 5	Application of VR in Digital Entertainment: VR Technology in Film & TV Production, VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.	8

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SAR501	CONCEPTS OF DIGITAL MANUFACTURING	L	T	P	C
		3	0	0	3

Contents		Hours
Unit 1	INTRODUCTION TO DIGITAL MANUFACTURING: Definition of digital manufacturing, Operation Mode and Architecture of Digital Manufacturing System.	8
Unit 2	CAD MODELING: Design process and role of CAD, Types and applications of design models, Three dimensional modeling schemes, Wire frames and surface representation schemes, Solid modeling - Parametric modeling, Assembly modeling.	8
Unit 3	REVERSE ENGINEERING: Need, Reverse engineering process, Reverse engineering hardware and software, Geometric model development.	8
Unit 4	COMPUTER AIDED MANUFACTURING: Component modeling, Machine and tool selection, Defining process and parameters, Tool path generation, Simulation, Post processing.	8
Unit 5	DIGITAL FACTORY AND VIRTUAL MANUFACTURING: Introduction, Scope, Methods and Tools Used in Virtual Manufacturing, Benefits. Virtual factory simulation.	8

Suggested Readings :

- 1. Anatomy ARVR: Augmented Reality and Virtual Reality Powered Book, BK Books, Limited, 2017**
- 2. Complete Virtual Reality and Augmented Reality Development with Unity
By Jesse Glover, Jonathan Linowes**
- 3. Introduction to XR, VR, AR, and MR: (virtual reality, augmented reality, mixed), By G.S.SRIDHAR**



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SAR601	VIRTUAL REALITY SYSTEMS	L	T	P	C
		3	0	0	3

Contents		Hours
Unit 1	VIRTUAL REALITY AND VIRTUAL ENVIRONMENTS: The historical development of VR: Scientific landmarks Computer Graphics, Real-time computer graphics, Flight simulation, Virtual environments, Requirements for VR, benefits of Virtual reality.	8
Unit 2	HARDWARE TECHNOLOGIES FOR 3D USER INTERFACES: Visual Displays Auditory Displays, Haptic Displays, Choosing Output	8
Unit 3	HARDWARE TECHNOLOGIES FOR 3D USER INTERFACES: Visual Displays Auditory Displays, Haptic Displays, Choosing Output.	8
Unit 4	3D USER INTERFACE INPUT HARDWARE: Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Home - Brewed Input Devices, Choosing Input Devices for 3D Interfaces.	8
Unit 5	3D INTERACTION TECHNIQUES: 3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Design Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Way finding, User Centered Way finding Support, Environment Centered Way finding Support, Evaluating Way finding Aids, Design Guidelines, Beyond Text and Number entry. VIRTUAL REALITY APPLICATIONS: Engineering, Architecture, Education, Medicine, Entertainment, Science, Training.	9

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1. Augmented Reality and Virtual Reality: The Power of AR and VR for Business
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SAR701	COMPUTER GRAPHICS FOR VIRTUAL REALITY	L	T	P	C
		3	0	0	3

Contents		Hours
Unit 1	GRAPHICS SYSTEM AND MODELS: Applications of Computer Graphics, Graphics System, Physical and Synthetic Images, Imaging Systems, Graphics Architectures.	10
Unit 2	OpenGL GRAPHICS PROGRAMMING: The OpenGL API, Primitives and Attributes, Color, Control functions, Adding Interaction. VIEWING: Positioning of the Camera, Parallel Projections, Perspective Projections, Open GL Projection Matrices.	12
Unit 3	LIGHTING AND SHADING: Light and Matter, Light Sources, The Phong Reflection Model, Computation of Vectors, Polygonal Shading, Approximation of a Sphere by Recursive Subdivision, Specifying Lighting Parameters, Implementing a Lighting Model, Shading of the Sphere Model, Per-Fragment Lighting, Global Illumination.	10
Unit 4	HIERARCHICAL MODELING: Symbols and Instances, Hierarchical Models, A Robot Arm, Trees and Traversal, Use of Tree Data Structures, Other Tree Structures, Scene Graphs, Open Scene Graph.	8

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SAR801	MODELING AND SIMULATION OF VIRTUAL SYSTEMS	L	T	P	C
		3	0	0	3

Contents		Hours
Unit 1	INTRODUCTION: Building a VR system, 3D multi modal interaction, VR software in modeling and simulation of engineering systems- use of discrete event simulation.	8
Unit 2	3D MULTI MODAL INTERACTION: Structured Approach to Interaction / Interface Design, Metaphors, Interface Design, Multimodality, Case Studies.	12
Unit 3	SIMULATION: Handling Collision, Collision Detection with Line Segments, Collision Among Polygonal Models, Bounding Volumes, Collision Among Bounding Volumes, Motion and Collision Response, Deformation, Motion Control, Forward and Inverse Kinematics	8
Unit 4	SIMULATION OF QUEUEING SYSTEMS: Simulation of a single server queue, simulation of a two server queue, simulation of more general queues.	8
Unit 5	SIMULATION LANGUAGES: GPSS, SIMSCRIPT, SIMULA.	6

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