(3 Hours) **[Total Marks : 80]**

N.B.: (1) **Question No. 1 is compulsory.**
(2) Write any three questions out of remaining.
(3) Assume suitable data if required.
(4) Draw suitable diagrams wherever necessary.

1	(a)	Compare mixed reality, virtual reality, immersive reality, extended reality with diagram.	5
	(b)	What are all Input devices used in VR? How does game controller, joysticks and gloves devices are used in VR	5
	(c)	Explain the concept of 6 degree of freedom	5
	(d)	Discuss frame rate and display with respect to AR and VR	5
2	(a)	How does homogenous coordinate system simplifies geometric transformations in computer graphics. What are the merits of using homogeneous coordinates. Write down the Homogeneous Transformation matrix for scaling, Rotation and Translation with different axis.	10
	(b)	How does viewport transformation help in adjusting for interfacing window with the screen. List applications and advantages of it.	10
3	(a)	List the Requirement of AR Authoring. Explain Elements of Authoring.	10
	(b)	What are all input and output modalities. Explain them briefly	10
4	a)	Explain the terms tangible interfaces, virtual user interfaces on real surfaces, Multiview interfaces.	10
	(b)	(b) Discuss in detail : multimodal display, optical tracking, Natural Feature Tracking by Detection.	10
5.	(a)	Explain the terms Sensor fusion, outdoor tracking, multiple camera infrared tracking.	10
	(b)	Define Virtual reality. Explain the components of it with diagram	10
6		Write short note on - (Solve any two).	20

(a) VRML
(b) JAVA 3D
(c) Neuroscience of vision

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