

(3 hours)

Total Marks: 80

- N.B.**
1. Question No. 1 is compulsory
 2. Attempt any **three** questions from remaining five questions
 3. Assume suitable data if **necessary** and justify the assumptions
 4. Figures to the **right** indicate full marks

Q1	Marks
A Enumerate and explain the architecture of a typical Augmented Reality system. Provide real-world use cases to illustrate each component's importance.	05
B Compare and contrast optical tracking and inertial tracking methods in AR/VR. Highlight scenarios where each is most effective.	05
C Describe the significance of visual depth cues and how they affect user experience in virtual reality.	05
D A tech company plans to launch an AR navigation app for visually impaired users. Design a system architecture including hardware and software choices, and critically evaluate key user safety, accessibility, and social challenges involved.	05
Q2 A Apply coordinate system transformations to compute the new position of an object located at (4, 2) after a translation by (3, 4) and a rotation of 90 degrees counterclockwise about the origin. Show all the calculations and final coordinates.	10
B Illustrate with diagrams the main differences between Head-Mounted Displays (HMDs), Handheld devices, and Spatial augmented reality displays. Discuss the advantages and limitations of each for immersive applications.	10
Q3 A Differentiate marker-based, marker-less, and hybrid tracking systems in AR, citing at least one application example for each.	10
B Explain the process and importance of registration in AR. How can registration errors impact the alignment between virtual and real environments?	10
Q4 A Develop and justify a checklist of data flow requirements for a collaborative AR/VR application, ensuring smooth performance and synchronization among multiple users.	10
B Depict the human auditory pathway and illustrate how spatialized audio enhances immersion in AR/VR environments.	10
Q5 A Summarize the use of AR and VR in manufacturing and astronomy. For each field, discuss one example application and describe the benefits realized.	10
B Evaluate the moral, social, and legal issues of persistent AR overlays in public spaces. Suggest at least two policy measures for responsible deployment.	10
Q6 A Demonstrate, with the help of a simple diagram, how a scene graph structures the rendering pipeline in a virtual environment. Discuss the benefits of using scene graphs.	10
B Compare and contrast camera intrinsic and extrinsic parameter calibration techniques. Explain situations in AR where each technique is critical.	10