(3 hours)   **Total Marks: 80**

N.B. 1. Question No. 1 is compulsory
      2. Attempt any three questions from remaining five questions

Q1   Answer any four questions from the following.

   A Explain the spectrum of virtual reality technologies. Clearly specify the difference between them giving examples.   **05**

   B Define MR. Write some of the applications of MR.   **05**

   C Explain the concept of transitional interfaces. What situations are they advantageous to use in?   **05**

   D Describe the attention funnel approach of navigation design. State its advantages over visualization.   **05**

   E What are the security and privacy issues in VR?   **05**

Q2 **A** What is prototyping? What is the need of developing prototypes? What are its advantages? How is it different from VR modeling?   **10**

   B Explain any five VR Design principles in detail. For each principle, give an example to demonstrate the importance of that principle.   **10**

Q3 **A** What are the techniques for 3D interaction? Explain the selection and manipulation technique in detail. Apply it for designing an application and write the details.   **10**

   B Explain the double diamond design process for XR with a neat diagram. Implement this process for creating a simple 2 player game and write the outcomes of each of the four steps of the design process.   **10**

Q4 **A** Explain in brief any 5 key aspects of 3D navigation in Virtual Reality.   **10**

   B What are challenges in VR interaction? Explain any five in detail.   **10**

Q5 **A** Explain the concept of location based AR apps giving examples.   **05**

   B What are the characteristics of the tracking technologies in AR and VR? Explain any five in brief.   **05**

   C How is computer vision useful in AR? Explain some of its applications in AR.   **05**

   D Explain the social implications of AR-VR.   **05**

Q6 **A** What are the AR design principles? Explain any five in brief.   **10**

   B What are the key issues in Extended Reality? Explain any five in detail.   **10**

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