

---

## CURRENT PLACEHOLDER, SOME SUMMARY HAS EMOJI PLEASE HELP REMOVING THEM

---

| Category  | # Ques- | Description   | Typical Questions  |
|---|---------|---|--|
| <b>Side Ques-tions (Conceptual Theory)</b>                                      | 13      | Key oral theory concepts: phase center, grating lobes, mutual coupling, miniaturization, and CEM methods. | - What is the phase center? - What are grating lobes? - What's the Wheeler-Chu limit? - What's the difference between DE and IE methods? - Why is miniaturizing antennas difficult? - What is mutual coupling? |
| <b>Antenna Fundamentals (<math>\lambda</math>, <math>f</math>, Friis, Gain)</b> | 6       | Core topics: frequency-wavelength, Friis, gain, effective area.   | - What is the wavelength at 3GHz? - Derive and explain the Friis equation. - How can $P_r > P_t$ be explained? - Can aperture efficiency exceed 1?   |
| <b>Scattering &amp; Electromagnetic Theory</b>                                  | 5       | Modeling materials in EM fields, relation of scattered and total fields.                                  | - What happens when a scatterer is a PEC or dielectric? - Solve $E_{tot} = E_{inc} + E_{scat}$ . - Describe the role of induced currents.  |
| <b>Slot and Microstrip Antennas</b>   | 5       | Radiation from slots, patch resonance, equivalence use.   | - Explain how a microstrip antenna works. - What resonates and in which direction? - Use equivalence theorem to analyze a slot.  |
| <b>Dipole and PEC Image Problems</b>  | 4       | Image theory and PECs affecting dipole fields.  | - Draw the image of a dipole over PEC. - What is the far field of a dipole near PEC? - What height gives optimal directivity?  |
| <b>Far Field Radiation &amp; Antenna Patterns</b>                               | 4       | Calculate radiated E and H fields from simple sources.  | - Use elementary dipole formulas to find far field. - What is the pattern in the $\phi = \pi/2$ plane? - Derive $F(r)$ for a radiating dipole.   |

---

---

---

| Category  | #<br>Ques-<br>tions | Description   | Typical Questions  |
|---|---------------------|---|--|
| <b>Nulls and Directivity</b>                          | 4                   | Placing nulls, shaping beam with geometry and phase.                    | - Find smallest $h$ to get a null at $\theta = 60^\circ$ . - How can antenna placement create nulls? - Optimize $h$ for main lobe targeting. |
| <b>Equivalence Theorems &amp; Boundary Conditions</b> | 3                   | Use of surface equivalence and physical meaning of boundary conditions. | - What does the equivalence theorem state? - Explain surface currents at PEC. - Why must E and H fields be continuous?                       |
| <b>Uniform Linear Array (ULA) Theory</b>              | 2                   | Element count vs pattern shaping, gain, and aperture.                   | - What happens to main lobe as $N \rightarrow \infty$ ? - How do grating lobes appear? - Prove scaling laws for gain and aperture.           |

---