

GUJARAT TECHNOLOGICAL UNIVERSITY

BE-6 SEMESTER – OLD PAPER – S22 TO W25 – QUESTION BANK

Subject Name & Code:

ANTENNAS AND PROPAGATION (3161003)

Unit 1: Basic Antenna Concepts

Repeated Questions:

1. **Define antenna in different ways / Explain the term "Antenna" in different ways.**
(W24 - Q2a, 03 marks)
(S22(1) - Q1a, 03 marks)
2. **Compare antenna with transmission line.**
(W24 - Q1b, 04 marks)
(Syllabus Topic)
3. **Explain radio communication link using Friis transmission formula.**
(S23(5) - Q1c, 07 marks)
(S25 - Q2c, 07 marks)

Other Important Questions:

4. **List down different types of antennas and explain any 2 with necessary figures.**
(S25 - Q1c, 07 marks)
 5. **List down antenna radiating regions. What are near field and far field regions?**
(S25 - Q2a, 03 marks)
 6. **Explain reciprocity theorem for antennas.**
(W24 - Q1a, 03 marks)
 7. **Explain effect of ground on ungrounded antenna.**
(S22 - Q2a, 03 marks)
 8. **State and prove reciprocity theorem to antennas.**
(W24 - Q1a, 03 marks)
 9. **Explain the term "Antenna" in different ways.**
(W24 - Q2a, 03 marks)
 10. **Is it possible to design lossless antenna? Justify your answer.**
(W24 - Q2b, 04 marks)
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Unit 2: Radiation of Electric Dipole & Antenna Parameters

Repeated Questions:

1. **Derive far-field components of a short dipole / electric dipole in spherical coordinates.**
(W22 - Q2c OR, 07 marks)
(W24 - Q2c OR, 07 marks)
(S23(2) - Q2c OR, 07 marks)
2. **Define/Explain: HPBW, FNBW, Directivity, Gain, Radiation Intensity, Efficiency, Aperture.**
(Multiple papers across units)
3. **Derive Friis transmission formula.**
(S22 - Q1b, 04 marks)
(S25 - Q2c, 07 marks)

Other Important Questions:

4. **Derive expression for radiation resistance of half-wave dipole.**
(S22(2) - Q2c, 07 marks)
 5. **Define: Beam solid angle, Directivity, Antenna Aperture.**
(S22 - Q1a, 03 marks)
 6. **Show that directivity is inversely proportional to beam area.**
(S23(5) - Q2b, 04 marks)
 7. **The radiation resistance of an antenna is 80Ω and loss resistance is 10Ω . What is directivity in dB if power gain is 16?**
(S22(1) - Q3a, 03 marks)
 8. **An antenna has field pattern $E(\theta) = \cos^2 \theta$. Find HPBW and FNBW.**
(S25 - Q2b, 04 marks)
 9. **Calculate maximum effective aperture of microwave antenna with directivity 800 at 6 GHz.**
(W22 - Q3a OR, 03 marks)
 10. **Find distance from short dipole at 1MHz where radiation field equals induction field.**
(W22 - Q3b OR, 04 marks)
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Unit 3: Arrays of Point Sources & Loop Antennas

Repeated Questions:

1. **Explain principle of pattern multiplication.**
(S22(1) - Q2b, 04 marks)
(S25 - Q3a, 03 marks)
(W25 - Q3b, 04 marks)
2. **Explain/Derive array factor for 2 isotropic point sources (same/opposite phase).**
(W24 - Q2c, 07 marks)
(S25 - Q3b, 04 marks)
3. **Explain binomial array.**
(S22(1) - Q3c OR(ii), 07 marks)
(S23(5) - Q3c, 07 marks)
(S22 - Q1c, 07 marks)

Other Important Questions:

4. **Explain Schelkunoff theorems for linear arrays.**
(S22(1) - Q3c OR(i), 07 marks)
(S22(2) - Q4b, 04 marks)
 5. **Explain Dolph-Tchebysheff distribution for linear arrays.**
(S22 - Q2b, 04 marks)
(W22 - Q5b, 04 marks)
 6. **Differentiate broadside and endfire array.**
(W22 - Q4b, 04 marks)
(W25 - Q3a OR, 03 marks)
 7. **Draw field pattern of array of 4 isotropic sources spaced $\lambda/2$ apart.**
(S22(1) - Q4b, 04 marks)
 8. **Derive far-field components of small loop antenna.**
(S22(2) - Q2c OR, 07 marks)
(W25 - Q3c OR, 07 marks)
 9. **Compare far field of small loop with short dipole.**
(W22 - Q3b, 04 marks)
(W24 - Q5b OR, 04 marks)
 10. **Explain folded dipole antenna.**
(S22(2) - Q3b, 04 marks)
(S22 - Q4b, 04 marks)
(W25 - Q4a, 03 marks)
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Unit 4: Helical, Yagi-Uda, Reflector & Slot Antennas

Repeated Questions:

1. **Explain Yagi-Uda antenna (3/4-element, construction, features).**
(S22(1) - Q4a, 03 marks)
(S22(2) - Q4b, 04 marks)
(S23(5) - Q3a, 03 marks)
(S25 - Q4a, 03 marks)
2. **Explain Babinet's principle for slot/complementary antennas.**
(S22(1) - Q5c, 07 marks)
(S22 - Q3c, 07 marks)
(S23(5) - Q4b, 04 marks)
(W25 - Q4b, 04 marks)

Other Important Questions:

3. **Explain helical antenna geometry, pitch angle, axial/normal mode.**
(S22(1) - Q3a OR, 03 marks)
(S22(2) - Q5b, 04 marks)
(W25 - Q3c, 07 marks)
 4. **Explain parabolic reflector antennas, feed techniques, f/D ratio.**
(W22 - Q4c, 07 marks)
(W24 - Q5c OR, 07 marks)
 5. **Explain Cassegrain feed system.**
(S22(2) - Q4a, 03 marks)
(S22 - Q4c, 07 marks)
 6. **Explain slot antenna working/construction.**
(W22 - Q4a, 03 marks)
(S25 - Q4b, 04 marks)
 7. **Explain log periodic antenna design/working.**
(W22 - Q2c, 07 marks)
(S22(2) - Q5b, 04 marks)
(S23(5) - Q5b, 04 marks)
 8. **Explain microstrip patch antenna radiation mechanism/design.**
(S22(1) - Q4c, 07 marks)
(S22(2) - Q5a, 03 marks)
(S23(5) - Q4c, 07 marks)
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Unit 5: Lens, Frequency Independent & Special Application Antennas

Repeated Questions:

1. **Explain lens antenna types (non-metallic, artificial dielectric).**
(S22 - Q2c, 07 marks)
(W22 - Q4a OR, 03 marks)
(W25 - Q5b, 04 marks)
2. **Explain frequency independent / log periodic antenna.**
(S22(2) - Q5b, 04 marks)
(S22(1) - Q5b, 04 marks)

Other Important Questions:

3. **Explain UWB antenna.**
(S22(2) - Q5b OR, 04 marks)
(S23(5) - Q4a, 03 marks)
(W25 - Q4b, 04 marks)
 4. **Explain smart antennas.**
(S25 - Q4c, 07 marks)
 5. **Explain antennas for satellite/mobile communication.**
(S22(1) - Q5a OR, 03 marks)
(W24 - Q5a OR, 03 marks)
 6. **Explain artificial dielectric lens antenna and derive effective refractive index.**
(S22(2) - Q5c OR, 07 marks)
 7. **Explain phased / frequency scanning arrays.**
(S22 - Q2c OR, 07 marks)
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Unit 6: Antenna Measurements

Repeated Questions:

1. **Explain experimental setup for measurement of radiation pattern/gain.**
(S22(1) - Q5c, 07 marks)
(S22(2) - Q5c, 07 marks)
(W24 - Q3c OR, 07 marks)

Other Important Questions:

2. **Explain phase measurement methods in antenna systems.**
(S22(2) - Q4c, 07 marks)
(W22 - Q4a OR, 03 marks)
 3. **List gain measurement methods and explain any two.**
(S23(5) - Q5c, 07 marks)
(W25 - Q4c, 07 marks)
 4. **Describe procedure for measurement of gain of antenna under test.**
(W22 - Q3c OR, 07 marks)
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Unit 7: Radio Wave Propagation

Repeated Questions:

1. **Explain different modes of radio wave propagation (ground, sky, space).**
(S22(1) - Q4c, 07 marks)
(S22(2) - Q1c, 07 marks)
(S23(5) - Q5c, 07 marks)
2. **Define: MUF, Virtual Height, Skip Distance, Critical Frequency.**
(S22(2) - Q5a, 03 marks)
(S23(5) - Q5a, 03 marks)
(W25 - Q5a OR, 03 marks)

Other Important Questions:

3. **Explain structure of ionosphere/ionization layers.**
(S22(1) - Q1b, 04 marks)
(S23(5) - Q5b, 04 marks)
(W24 - Q5b OR, 04 marks)
 4. **Explain super refraction, multi-hop propagation, skip zone.**
(S22(2) - Q4c, 07 marks)
(W22 - Q5a, 03 marks)
(W24 - Q5b, 04 marks)
 5. **Explain surface wave propagation.**
(S22(2) - Q5a, 03 marks)
 6. **Explain duct propagation.**
(S22(1) - Q5b(i), 04 marks)
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Unit 8: Arrays of Dipoles & Apertures

Repeated Questions:

1. **Explain 3-element Yagi-Uda array / parasitic elements.**
(S22(1) - Q4a, 03 marks)
(S22(2) - Q4b, 04 marks)
(W25 - Q3b OR, 04 marks)
2. **Explain folded dipole antenna and matching arrangements.**
(S22(2) - Q3b, 04 marks)
(S22 - Q4b, 04 marks)
(W25 - Q4a, 03 marks)

Other Important Questions:

3. **Explain phased arrays / frequency scanning arrays.**
(S22 - Q2c OR, 07 marks)
 4. **Explain long wire antennas.**
(Syllabus topic)
 5. **Explain location methods of feeding antennas.**
(Syllabus topic)
 6. **Explain smart antennas.**
(S25 - Q4c, 07 marks)
 7. **Explain array of dipoles with parasitic elements.**
(Syllabus topic)
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Unit 9: Reflector Antennas

Repeated Questions:

1. **Explain parabolic / paraboloidal reflector antennas, feed techniques, f/D ratio.**
(W22 - Q4c, 07 marks)
(W24 - Q5c OR, 07 marks)
2. **Explain Cassegrain feed system.**
(S22(2) - Q4a, 03 marks)
(S22 - Q4c, 07 marks)

Other Important Questions:

3. **Calculate diameter of parabolic dish antenna for given gain (40 dB at 11 GHz).**
(S22 - Q3a OR, 03 marks)
 4. **Explain aperture pattern of large circular apertures with uniform illumination.**
(Syllabus topic)
 5. **Explain off-axis operation of paraboloidal reflectors.**
(Syllabus topic)
 6. **Explain reflector lens antennas.**
(Syllabus topic)
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Unit 10: Slot, Patch & Horn Antennas

Repeated Questions:

1. **Explain Babinet's principle for slot antennas.**
(S22(1) - Q5c, 07 marks)
(S22 - Q3c, 07 marks)
(S23(5) - Q4b, 04 marks)
2. **Explain microstrip patch antenna radiation mechanism, design, applications.**
(S22(1) - Q4c, 07 marks)
(S22(2) - Q5a, 03 marks)
(S23(5) - Q4c, 07 marks)

Other Important Questions:

3. **Explain horn antenna types, function, optimum dimensions.**
(S22(2) - Q3a, 03 marks)
(S25 - Q3b OR, 04 marks)
(W22 - Q3c OR, 07 marks)
 4. **Explain slot antenna patterns and impedance.**
(W22 - Q4a, 03 marks)
(Syllabus topic)
 5. **Explain complementary antennas using Babinet's principle.**
(S22(1) - Q5c, 07 marks)
(W24 - Q3b OR, 04 marks)
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Unit 11: Lens Antennas

Repeated Questions:

1. **Explain non-metallic dielectric lens and artificial dielectric lens antennas.**
(S22 - Q2c, 07 marks)
(W22 - Q4a OR, 03 marks)
(W25 - Q5b, 04 marks)

Other Important Questions:

2. **Classify lens antennas and explain briefly.**
(W22 - Q4a OR, 03 marks)
 3. **Explain reflector lens antennas.**
(Syllabus topic)
 4. **Derive expression for effective refractive index of lens formed by conducting spheres.**
(S22(2) - Q5c OR, 07 marks)
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Unit 12: Broadband & Frequency Independent Antennas

Repeated Questions:

1. **Explain log periodic antenna as frequency independent antenna.**
(S22(1) - Q5b, 04 marks)
(S22(2) - Q5b, 04 marks)
2. **Explain broadband antenna concepts.**
(Syllabus topic)

Other Important Questions:

3. **Explain frequency independent antennas.**
(S22(2) - Q5b, 04 marks)
(W24 - Q3a OR, 03 marks)
 4. **Draw and explain log periodic wire antenna.**
(S25 - Q4c, 07 marks)
 5. **Explain wideband characteristics of helical antenna.**
(S22(1) - Q7, Syllabus topic)
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Unit 13: Antennas for Special Applications

Repeated Questions:

1. **Explain antennas for satellite communication.**
(S22(1) - Q5a OR, 03 marks)
2. **Explain antennas for mobile communication.**
(W24 - Q5a OR, 03 marks)

Other Important Questions:

3. **Explain UWB antenna for digital applications.**
(S22(2) - Q5b OR, 04 marks)
 4. **Explain GPR, embedded antennas, plasma antennas.**
(Syllabus topic)
 5. **Explain design considerations for satellite communication antennas.**
(Syllabus topic)
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Unit 14: Antenna Measurements

(Already covered in Unit 6, but repeated here as per syllabus numbering)

Repeated Questions:

1. **Explain experimental setup for measurement of radiation pattern / gain / phase / polarization / impedance.**
(S22(1) - Q5c, 07 marks)
(S22(2) - Q5c, 07 marks)
(W24 - Q3c OR, 07 marks)

Other Important Questions:

2. **Explain phase measurement method.**
(S22(2) - Q4c, 07 marks)
(W22 - Q4a OR, 03 marks)
 3. **Explain gain measurement methods (any two).**
(S23(5) - Q5c, 07 marks)
(W25 - Q4c, 07 marks)
 4. **Describe procedure for gain measurement of antenna under test.**
(W22 - Q3c OR, 07 marks)
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Unit 15: Radio Wave Propagation

(Already covered in Unit 7, but repeated here as per syllabus numbering)

Repeated Questions:

1. **Explain modes of propagation: ground, sky, space wave.**
(S22(1) - Q4c, 07 marks)
(S22(2) - Q1c, 07 marks)
(S23(5) - Q5c, 07 marks)
2. **Define: MUF, Virtual Height, Skip Distance, Critical Frequency.**
(S22(2) - Q5a, 03 marks)
(S23(5) - Q5a, 03 marks)
(W25 - Q5a OR, 03 marks)

Other Important Questions:

3. **Explain structure of ionosphere / ionization layers.**
(S22(1) - Q1b, 04 marks)
(S23(5) - Q5b, 04 marks)
(W24 - Q5b OR, 04 marks)
4. **Explain super refraction, multi-hop propagation, skip zone.**
(S22(2) - Q4c, 07 marks)
(W22 - Q5a, 03 marks)
(W24 - Q5b, 04 marks)
5. **Explain fading, ionospheric absorption, OWF.**
(Syllabus topic)
6. **Explain duct propagation.**
(S22(1) - Q5b(i), 04 marks)
