Q.1: a) Definition of polarization
   types of polarization
   description of each
   (2 m)
   (1 m)
   (2 m)

   b) What is feed mechanism & types
   explanation of any one
   with diagram.
   (1 m)

   c) Antenna radiation mechanism
   with explanation
   (2 m)

   d) Significance of each control
   (5 m each)

   e) Complete derivation
   (5 m)

Q.2: a) Description of dipole
   (2 m)
   Fig. 1 (field distribution)
   (2 m)
   Fig. 2 ( )
   (2 m)
   Fig. 2 ( )
   (2 m)

   b) Proper sketch of pyramidal horn antenna
   Explanation of horn
   (2 m)
   (2 m)
   Effect of aperture on radiation pattern
   (3 m)
   Effect of length of horn on radiation pattern
   (3 m)

Q.3: a) Proper diagram of Yagi-Uda antenna
   Explanation
   (2 m)
   Effect of length of each element on radiation pattern
   (3 m)
   Effect of spacing between
   (3 m)

   b) May diagram & equivalent circuit of folded dipole
   Explanation of the same
   (5 m)
1. Given: 2m°, Z = 10 dB, E = 26 dB
   \[ \frac{E}{2} = 26 dB \]

2. Expansion of (AF):
   \[ \frac{E}{2} = 20 \log_{10} (\frac{Z}{2}) \]

3. Determine Z0 by equality:
   \[ Z_0 = \frac{2}{5} \]

4. Substitute:\n   \[ Z_0 = \frac{2}{5} \]

5. Solve for AF:
   \[ AF = \frac{Z_0}{Z} \]

6. Equate the AF of step 2: after this substitution, from
   \[ (AF)_2 = \left( \frac{0.82 + 0.83 - 0.83 + 0.83}{0.83} \right) \]
   \[ + \left( 0.83 - 1.24 + 1.82 \right) \]
   \[ + \left[ \left( 0.83 - 0.83 - 1.24 \right) \right] \]
   \[ + \left[ 0.83 - 1.24 + 1.82 \right] \]
   \[ + \left[ 0.83 - 1.24 + 1.82 \right] \]
   \[ + \left[ 0.83 - 1.24 + 1.82 \right] \]

7. Final result:
   \[ 2 - 120.2 Z^2 + 632.2 - 576.2 + 128.2 \]
   \[ = 9 - 120.2 Z^2 + 576.2 + 128.2 \]
Matching similar terms allows the determination of the $a_n$, i.e.

$$256 a_5 / 20 = 25.6 \quad \Rightarrow \quad a_5 = 20.86$$

$$\frac{64 a_4 - 576 a_5}{20} = -57.6 \quad \Rightarrow \quad a_4 = 2.832$$

$$\frac{16 a_3 + 12 a_4 + 432 a_5}{20} = 43.2 \quad \Rightarrow \quad a_3 = 4.1184$$

$$\frac{9 a_2 - 20 a_3 + 544 a_4 - 12 a_5}{20} = -120 \quad \Rightarrow \quad a_2 = 5.2073$$

$$\frac{a_1 - 3 a_2 + 5 a_3 - 7 a_4 + 9 a_5}{20} = a \quad \Rightarrow \quad a_1 = 5.8377$$

In normalized form, the coefficients can be written as

$$a_5 = 1 \quad a_5 = 0.357$$

$$a_4 = 2.357 \quad a_4 = 0.485$$

$$a_3 = 1.974 \quad a_3 = 0.705$$

$$a_2 = 2.496 \quad a_2 = 0.890$$

$$a_1 = 2.798 \quad a_1 = 1$$

Using the first (left) set of normalized coefficients, the carry factor can be written as

$$(AF)_{10} = 2.798 \cos(u) + 2.496 \cos(3u) + 1.974 \cos(5u) + 0.705 \cos(7u) + 0.890 \cos(9u)$$

Q. 1.5 (a) Given $f = 5.86 \text{ Hz}$, $\varepsilon = 4$, $h = 2.6 \text{ mm} = 0.16 \text{ cm}$

Solution:

Radius of patch

$$\text{Radius} = \sqrt[\frac{1}{2}] { \frac{2 h}{\varepsilon} \left[ \ln \left( \frac{h F}{2 \varepsilon} \right) + 1.7726 \right] } = 0.525 \text{ cm} = 5.25 \text{ mm}$$

$$F = 8.791 \times 10^9 \frac{1}{\varepsilon \sqrt{\varepsilon}} = 8.543$$
a) With diagram, explanation of ionsphere propagation

b) Calculation of distances & reflections = (14/3 m)

c) Maximum usable frequency (m) = (14/3 m)

d) Block diagram of propagation measurement

e) Explanation of why & significance

f) Explanation with functional diagram

g) Diagram of each field with its range