Assignment-5 Solutions

1. (b). If you move from one edge to other edge of RMSA, its phase changes by 180° (b)

2. (b). If feed point of RMSA is moved along the length towards the edge of patch, its impedance curve shifts toward higher impedance. (b)

Common data: $f = 2300\,MHz$, $\varepsilon_r = 2.2$, $h = 1.6\,mm$, $tan\delta = 0.001$

3. (C) Width of RMSA

$$W = \frac{c}{2f\sqrt{\frac{\varepsilon_r+1}{2}}} = \frac{3\times10^{10}}{2\times2300\times10^6\times\sqrt{\frac{2.2+1}{2}}}$$

$$= 51.6\,mm$$

Approximate width of RMSA will be 52 mm (C)

4. (C). Effective dielectric const

$$\varepsilon_{eff} = \frac{\varepsilon_r+1}{2} + \frac{\varepsilon_r-1}{2}\left(1+\frac{10h}{W}\right)^{-\frac{1}{2}}$$

$$\varepsilon_{eff} = \frac{2.2+1}{2} + \frac{2.2-1}{2}\times\left(1+\frac{10\times1.6}{52}\right)^{-\frac{1}{2}}$$

$$\varepsilon_{eff} = 2.12$$

Effective dielectric constant of antenna will be 2.12 (C)

5. (b)

$$L_{eff} = \frac{c}{2f\sqrt{\varepsilon_{eff}}} = \frac{3\times10^{11}}{2\times2300\times10^6\times\sqrt{2.12}} = 44.8\,mm$$

$$\Delta L = \frac{h}{\sqrt{\varepsilon_{eff}}} = \frac{1.6}{\sqrt{2.12}} = 2.2\,mm \qquad L = L_{eff} - 2\Delta L = 42.6\,mm$$

Approx. length of RMSA will be 42.6 mm (b)

6. (C). Approx feed location should be between $\lambda/6$ to $\lambda/4$

λ = b/w 7.1 mm to 10.65 mm

Among the given options 9 mm feed point location from centre is appropriate to match with 50Ω. (C)

7. (b) Approximate gain of antenna will be 6.5 dBi (b)

Common data for Q 8 & 9: $f = 2.45$ GHz,

$\varepsilon_r = 2.55$, $h = 1.6$ mm, $\tan\delta = 0.0012$

8. (C) $\varepsilon_e \leq \varepsilon_r$ for circular MSA

$\varepsilon_e = 2.45$

$$f_0 = \frac{8.791}{\left(a + \frac{h}{\sqrt{\varepsilon_r}}\right)\sqrt{\varepsilon_e}}$$

$$2.45 = \frac{8.791}{\left(a + \frac{0.16}{\sqrt{2.55}}\right) \times \sqrt{2.45}}$$

$a = 2.16$ cm $= 21.6$ mm

Circular patch radius will be 21.6 mm (C)

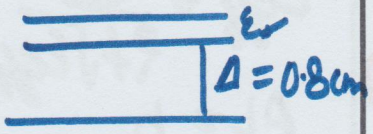
9. (d) feed point location is between $0.3a$ to $0.5a$

6.48 mm to 10.8 mm

Most appropriate options of feed point will be 7.8 mm

Common data for Q 10 & 11:

$\varepsilon_r = 4.4$, $h = 0.16$ cm, $L = 8$ cm, $W = 9$ cm



$$\varepsilon_{eq} = \frac{\varepsilon_r(h+\Delta)}{h+\Delta\varepsilon_r} = 1.15$$

10. (a)

$$\varepsilon_{eff} = \frac{\varepsilon_{eq}+1}{2} + \frac{\varepsilon_{eq}-1}{2}\left(1+0.8\times\frac{10(h+\Delta)}{W}\right)^{-\frac{1}{2}}$$

$$\varepsilon_{eff} = 1.13$$

Effective dielectric const is 1.13

11. (b)

$$L_{eff} = \frac{c}{2f\sqrt{\varepsilon_{eff}}} = 3$$

$L = 8\,cm \quad \Delta L = 0.8\times\frac{(h+\Delta)}{\sqrt{\varepsilon_{eff}}} = 0.72$

$$L_{eff} = L + 2\Delta L$$

$$L_{eff} = 9.44\,cm$$

$$f = \frac{3\times10^{10}}{2\times9.44\times\sqrt{2.13}} \simeq 1.5\,GHz$$

Approx. resonance freq of the antenna is 1.5 GHz (b)