- The Microware power ... an input signal into two outputs while maintaining impedance matching and isolation.
- It is widely used in RF, radar and communication systems to distribute signals effectively.

Example Problems:

Example 10.1 - Pg: 479

Soln:

given:

$f_{(Hz)} = 10\ GHz = 10 \times 10^{9}\ Hz$

$V_0 = 300V$

repeller Space $= 0.1\ (Lm)$

$N = 1\frac{3}{4} = \frac{7}{4} = 1.75$

$I_0 = 20mA = 20 \times 10^{-3}$

i) $P_{RFmax} = \frac{0.398 V_0 I_0}{N} = \frac{0.398 \times 300 \times 20 \times 10^{-3}}{1.75} = \underline{1.365\ watts}$

$L_{(m)} = 0.1 \times 10^{-2} m = \underline{10^{-3} m}$

ii) $|V_R| = 6.74 \times 10^{-6} f_{(Hz)} L_{(m)} \sqrt{V_0}/N - V_0$

$= 6.74 \times 10^{-6} \times 10 \times 10^{9} \times 10^{-3} \times \sqrt{300}/1.75 - 300$

$\underline{V_R = -367.08V}$

Example 10.2 - Pg : 479

Soln:

given:

$f = 5\,GHz = 5\times10^9\,Hz$

$V = 350V$

repeller spacing $= 0.5\,(Lm)$

$N = 3\frac{3}{4} = \frac{15}{4} = 3.75$, $\Delta V_R = 1$

$\Delta V_R = 6.7438\times10^{-6} \times Lm \times \Delta f_{Hz}\,\sqrt{V_0}/N$

$1 = 6.7438\times10^{-6} \times \frac{0.5}{100} \times 5\times10^9 \times \sqrt{350} \times \frac{4}{15}$

$1 = 6.7438\times10^{-6}\times 5\times10^{-3} \times 5\times10^9 \times 18.7\times 0.2$

$1 = 6.7438\times10^{-6}$

$= 630.54$

$\Delta f = 630.54\,MHz$

Example 10.3 - Pg : 482

Given:

$f_0 = 9\,GHz = 9\times10^9\,Hz$

$N = 1\frac{3}{4} = \frac{7}{4} = 1.75$

$V_0 = 600$ volt

$L = 1mm$

$\beta_1 = 1$

$I_0 = 10mA$

$\sqrt{600} = 24.49$

i) $|V_R| = 6.74\times10^{-6}\, f_{(Hz)}\, L_{(m)}\, \sqrt{V_0}/N - V_0$

$= 6.74\times10^{-6} \times 9\times10^9 \times 1\times10^{-3} \times \frac{\sqrt{600}}{1.75} - 600$

$= 6.74\times10^{-6}\times9\times10^9\times1\times10^{-3}\times13.99-600$

$= 6.74\times10^{-6}\times9\times10^9$

$V_R = 248.6\,V$

ii) $P_{RFmax} = \frac{0.398 V_0 I_0}{N} = \frac{0.398 \times 600 \times 10 \times 10^{-3}}{1.75}$

$= \frac{2.388}{1.75} = \underline{1.364 \text{ watts}}$

iii) $\eta_{max} = \frac{X J_1(X)}{\pi N} = \frac{0.398}{N} = \frac{0.398}{1.75} \times 100 = \underline{22.74\%}$

Example 10.5 - Pg: 491

Given:

$f = 5\,GHz = 5 \times 10^9\,Hz$

$V_0 = 10\,KV = 10 \times 10^3$

$d = 2\,mm$

$V = 100V$

Soln:

i) $U_0 = 0.593 \times 10^6 \sqrt{V_0}$

$= 0.593 \times 10^6 \times \sqrt{10 \times 10^3}$

$= 0.593 \times 10^6 \times \sqrt{10^{4}}$ ^{2}

$= 0.593 \times 10^6 \times 10^2$

$\underline{U_0 = 0.593 \times 10^8\ m/s}$

ii) $t_g = \frac{d}{U_0} = \frac{2 \times 10^{-3}}{0.593 \times 10^8} = \underline{33.7 \times 10^{-12}\ Sec}$

iii) $\theta_g = \omega t_g = 2\pi \times 5 \times 10^9 \times 33.7 \times 10^{-12}$ rad

$= 1.059$ rad $= 60.7$ deg

convert rad to deg

$\Rightarrow 1.059 \times \left(\frac{180}{\pi}\right)$

$= 1.059 \times 57.32$

$= 60.7$

iv) $\beta_1 = \frac{\sin(\theta g/2)}{\theta g/2} = \frac{\sin(30.35)}{0.5295} = \frac{0.505}{0.5295} = \underline{0.9537}$

v) $u(t) = u_0\left[1 + \frac{\beta_1 V_1}{2V_0} \sin(\omega_t + \theta g/2)\right]$

$= 0.593 \times 10^8 \left[1 + \left(\frac{0.954 \times 100}{2 \times 10 \times 10^3}\right) \sin(\omega_t + 0.5295)\right]$

$= 0.593 \times 10^8 \left[1 + \left(\frac{0.954 \times 100}{2 \times 10 \times 10 \times 10 \times 10}\right) \sin(\omega_t + 0.5295)\right]$

$= 0.593 \times 10^8 \left[1 + 0.00477 \sin(\omega_t + 0.5295)\right]$

$M/2 = 0.00477$

vi) $u(t)_{max} = u_0(1 + M/2) = 0.593 \times 10^8 (1 + 0.00477)$

$= \underline{0.5958 \times 10^8 \text{ m/s}}$

vii) $u(t)_{min} = u_0(1 - M/2) = 0.593 \times 10^8 (1 - 0.00477)$

$= \underline{0.5902 \times 10^8 \text{ m/s.}}$