UNIT-5

(Lecture-3)

High-Pass RC Network (Phasor Diagram)

- Substituting $\omega = 2\pi f$ and $CR = 1/\ 2\pi f_C$ in the earlier equation gives

$$\frac{v_o}{v_i} = \frac{1}{1 - j\dfrac{1}{\omega CR}} = \frac{1}{1 - j\dfrac{1}{(2\pi f)\left(\dfrac{1}{2\pi f_c}\right)}} = \frac{1}{1 - j\dfrac{f_c}{f}}$$

- This is the general form of the gain of the circuit
- It is clear that both the *magnitude* of the gain and the *phase angle* vary with frequency

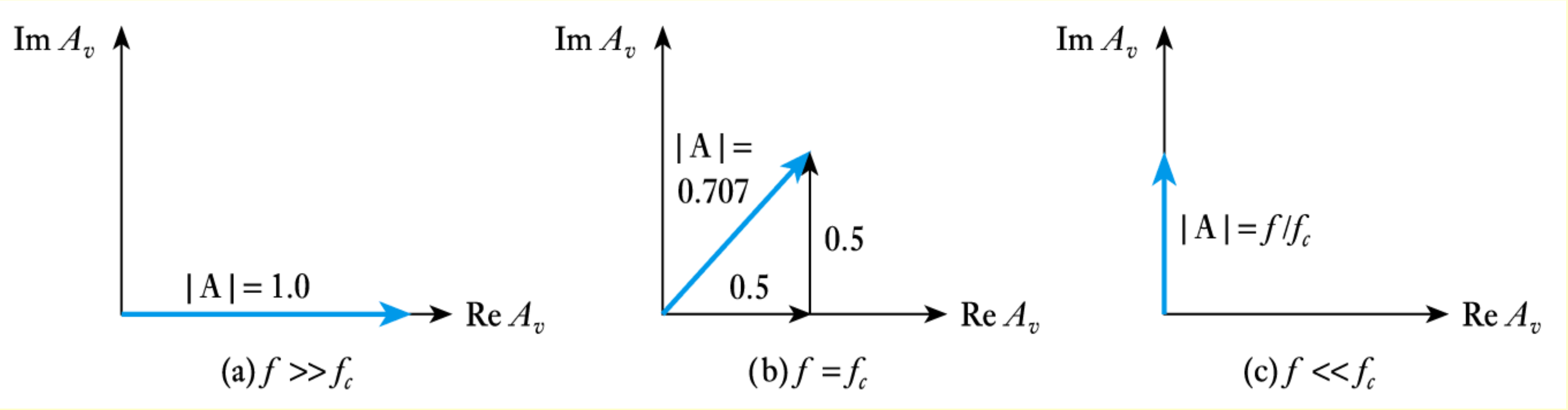
- Consider the behaviour of the circuit at different frequencies:
- **When $f >> f_c$**
  - $f_c/f << 1$, the voltage gain ≈ 1
- **When $f = f_c$**

$$\frac{v_o}{v_i} = \frac{1}{1 - j\frac{f_c}{f}} = \frac{1}{1 - j} = \frac{1 \times (1 + j)}{(1 - j) \times (1 + j)} = \frac{(1 + j)}{2} = 0.5 + 0.5j$$

- **When $f << f_c$**

$$\frac{v_o}{v_i} = \frac{1}{1 - j\frac{f_c}{f}} \approx \frac{1}{-j\frac{f_c}{f}} = j\frac{f}{f_c}$$

- The behaviour in these three regions can be illustrated using phasor diagrams



- At *low* frequencies the gain is linearly related to frequency. It falls at -6dB/octave (-20dB/decade)