Key Points for Electromagnetic Waves (II)

10. **Polarization:**
    - Describes the orientation of the electric field vector. Common types are linear, circular, and elliptical polarization.
11. **Plane Wave Solutions:**
    - Electromagnetic waves can be described as plane waves, where field vectors are uniform in planes perpendicular to the direction of propagation.
12. **Boundary Conditions:**
    - At the interface between two media, the continuity of the tangential components of $\vec{E}$ and $\vec{H}$ must be maintained.
13. **Reflection and Refraction:**
    - Governed by the laws of reflection and Snell's law, resulting from boundary conditions at interfaces.
14. **Complex Representation:**
    - Using phasor notation, the fields can be represented as complex vectors, simplifying the analysis of harmonic waves.
15. **Harmonic Waves:**
    - For sinusoidal steady-state conditions, the fields oscillate harmonically with time.
16. **Electromagnetic Spectrum:**
    - Electromagnetic waves cover a wide range of frequencies, including radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, and gamma rays.
17. **Energy Density:**
    - The energy density of an electromagnetic wave is given by: $u = \frac{1}{2}\left(\epsilon_0 E^2 + \frac{B^2}{\mu_0}\right)$
18. **Applications:**
    - Electromagnetic wave equations and field vectors are fundamental in telecommunications, radar systems, optical devices, and medical imaging technologies.