ELECTROMAGNETIC WAVES SUMMARY

- Displacement current can be defined as 'the current which comes into play in the region in which the electric field and the electric flux are changing with time'
- Maxwell modified Ampere's law as
  $\oint \vec{B} \cdot d\vec{S} = \mu_o I = \mu_o (I_c + I_d)$
- An electromagnetic wave is radiated by an accelerated charge which propagates through space as coupled electric and magnetic fields, oscillating perpendicular to each other and to the direction of propagation of the wave
- Electromagnetic wave is a transverse wave. They are non-mechanical wave and do not require any medium for propagation
- The instantaneous magnitude of the electric and magnetic field vectors in electromagnetic wave are related by E = Bc
- Electromagnetic waves are transverse in nature. This means that the oscillating electric field vector, oscillating magnetic field vector and propagation vector are (gives direction of propagation) mutually perpendicular to each other
- Electromagnetic waves can show interference, diffraction and also can be polarized
- The average energy density $\langle u \rangle = 2u_e = 2u_m = \varepsilon_\circ E^2 = \frac{1}{\mu_\circ} B^2$
- The energy crossing per unit area per unit time and perpendicular to the direction of propagation of electromagnetic wave is called the intensity, which is $I = \langle u \rangle c$
- If the electromagnetic wave incident on a material surface is completely absorbed, then the energy delivered is U and momentum imparted on the surface is $p = \frac{U}{c}$
- If the incident electromagnetic wave of energy U is totally reflected from the surface, then the momentum delivered to the surface is $\Delta p = \frac{U}{c} - \left(-\frac{U}{c}\right) = 2\frac{U}{c}$
- The rate of flow of energy crossing a unit area is known as poynting vector for electromagnetic waves, which is $\vec{S} = \frac{1}{\mu_\circ}\left(\vec{E} \times \vec{B}\right) = c^2 \varepsilon_\circ \left(\vec{E} \times \vec{B}\right)$.
- Electromagnetic waves carry not only energy and momentum but also angular momentum.
- Types of spectrum – emission and absorption
- When the spectrum of self luminous source is taken, we get emission spectrum. Each source has its own characteristic emission spectrum. The emission spectrum can be divided into three types: continuous, line and band.
- The spectrum obtained from the Sun is examined, it consists of large number of dark lines (line absorption spectrum). These dark lines in the solar spectrum are known as Fraunhofer lines.