Sheet (5)
Mid-Term Exam

1. **Derive** the inhomogeneous wave equation for magnetic vector potential $\vec{A}$ starting from Maxwell's equations. (***Solved in sheet1***)
2. **Describe** radiation mechanism for two wire antenna. (***Solved in sheet1***)
3. **Determine** the type of polarization for an incident wave whose electric field $\vec{E}$ = (j$\hat{x}$+2j$\hat{y}$)e^{+jkz} ; then calculate the polarization loss factor (PLF) for dipole antenna whose electric field polarization is expressed as $\vec{E}_a$=E(r,θ,Φ) $\hat{x}$ finally give the orientation of the antenna to maximally receive the field.
4. Determine the max power received at a distance of 0.75Km. Over a free space 1.9GHz circuit consisting of a transmitting antenna with 20dB gain and received antenna with 20dB gain? The gain is with respect to a lossless isotropic source. The transmitting antenna input is 50W.
5. If the electric far field for an antenna ; defined at 0≤ θ≤π/2 and 0≤ Φ≤2 π ; is given by:

$$\vec{E}_{\theta=} \frac{e^{-jkr}}{r} Cos(\theta)\widehat{a_\theta}$$

   Where; r is the distance of the observation point from the antenna. Compute
   (a) The total radiated power by the antenna.
   (b) Radiation resistance of the antenna if the peak current is 0.01Amp.
   (c) Directivity using exact and approximate Kraus formula.
6. For $\frac{\lambda}{2}$ dipole; derive the Directivity using exact method, then calculate R_r , A_{em} and HPBW. (Note use all possible cases ; try and error , modified cosine function , and approximation of $Cos\left(\frac{\pi}{2}Cos\theta\right) = Sin^{2.5}\theta$

Good Luck

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