Assign 01

1. At a frequency of ν a radio telescope antenna has a fan beam 5 deg by 20 deg wide between principal-plane half-power points. The sky at which the antenna is directed has a uniform brightness of $110^{-21} W\ m^{-2}\ Hz^{-1}\ rad^{-2}$ at the frequency ν. If the antenna has an effective aperture 36 m^2, find the total power received per unit bandwidth at the frequency ν.
2. A discrete radio source 2 deg in diameter has an actual average brightness B_{avg} of $10^{-20} W m^{-2} Hz^{-1} rad^{-2}$ at a frequency ν. The brightness is constant over a bandwidth 2 Hz at this frequency. Calculate (i) the actual flux density of the source at this frequency, (ii) the flux density observed with an antenna having a main beam area of 1 sq. deg, and (iii) the total actual flux density over a 2 MHz bandwidth.
3. Calculate the brightness of a blackbody radiator at a temperature of 6000 K and a wavelength of 0.5 micron.
4. A telescope, when directed at Mars, measured an antenna temperature of 0.24 K at a wavelength of 3.15 cm. At the time of measurement the disk of Mars subtended an angle of 18 arcsec. Assuming that the antenna has a pencil beam of 0.116 deg between half power points, find the equivalent temperature of the source (Mars).
5. A surface has an rms deviation $\sigma = \lambda/20$, Find the reduction in Gain (in dB).
6. For the triangular aperture distribution, find the far field pattern.