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**SE - 460**

**Total No. of Pages : 2**

# T.E. (E & Tc) (Semester - V) Examination, November - 2018
# ANTENNA AND WAVE PROPAGATION
## Sub. Code : 66314

**Day and Date : Monday, 19 - 11 - 2018** **Total Marks : 100**

**Time : 10.00 a.m. to 01.00 p.m.**

**Instructions :**
1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Use of non-programmable calculator is allowed.**
4) **Assume suitable data, if necessary.**

## SECTION - I

*Q1)* Attempt any two: **[16]**

a) The power radiated by a lossless antenna is low. The directional characteristics of the antenna are represented by the radiation intensity of

$$\left.\begin{aligned} U &= B_0 \cos^2\theta \\ U &= B_0 \cos^3\theta \end{aligned}\right\} \text{(watts/unit solid angle)} \quad (0 \le \theta \le \pi/2, 0 \le \phi \le 2\pi)$$

for each find:

i) Maximum power density at a distance of 1000 m

ii) Exact directivity in dB of the antenna.

b) Obtain the equations for effective aperture & effective height of antenna.

c) Derive the equation of total electric field for two isotropic point sources of same amplitude & phase for $\lambda/4$ spacing.

*Q2)* Attempt any two: **[16]**

a) Draw and explain infinite & finite biconical antennas.

b) i) What is the required diameter of conical horn antenna operated at 3 GHz with 20 dB gain.

ii) What is the required aperture area for optimum rectangular horn antenna operating at 2 GHz with 18 dB gain

c) Derive the equations for electric field due to non-isotropic & dissimilar point sources for $d=\lambda/2$

*P.T.O.*

*Q3)* Attempt any two: [18]

a) What is anechoic chamber? Explain in detail elevated & ground reflected range measurement techniques of antenna.

b) With neat diagram, explain construction, characteristics, advantages & limitations of microstrip patch antenna.

c) Design a rectangular microstrip antenna so that it will resonate at 2GHz. The idealistic lossless substate (RT/Duroid 6010.2) has a dielectric constant of 10.2 & a height of 0.05 inch (0.127 cm).

i) Determine the physical diamensions of the patch in cm.

ii) Approximate range of lengths in cm between two radiating slots of patch.

iii) What is the real input impedance of part (ii)

## SECTION - II

*Q4)* Attempt any two:

a) Explain plain earth reflection and derive equations for Rh & $R\vartheta$. [8]

b) Explain MTI RADAR in detail with the help of suitable block diagram. [8]

c) When the maximum electron density of the ionospheric layer corresponds to refractive index of 0.92 at the frequency of 10 MHz, find the range if the frequency is MUF itself. The height of the ray reflection point on the ionospheric layer is 400 k.m. Assume flat earth and neglegible effect of earths magnetic field. [8]

*Q5)* Attempt any two:

a) Explain in detail tropospheric propagation. [8]

b) What are RADAR becons, explain? State application RADAR becons and derive equation for becon range. [8]

c) A broadcast transmitter supplies 100 kw to an antenna that radiates 50% of this power. The antenna has directional characteristics such that the field strength without ground lossses is given by $E_0 = 300 \times 1.28 \sqrt{Pkw}$ mV/m at 1km. Find the field strength of ground wave at 100 km for the following types of earth conditions , for F = 1500 KHz.

i) Sea water earth $\Rightarrow$ Er = 81, 6 = $45 \times 10^{-3}$(mho)/cm

ii) Poor soil $\Rightarrow$ Er = 10,6 = $0.2 \times 10^{-4}$(mho)/cm [8]

*Q6)* Attempt any two:

a) Calculate maximum range of deep-space radar operating at 2.5 GHz and using peak pulse power of 25 MW. The antenna diameter is 64 m, the target cross section is $1m^2$ and reciever noise figure is 1.1. The reciever bandwidth is 5KHz. [9]

b) Explain effect of earth's magnetic field in detail. [9]

c) With the help of $E_z$ & $E_r$, explain how norton has reduced the complexicity of space & surface wave. [9]

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