SJ - 783

Seat No.	

Total No. of Pages : 3

T.E. (E & TC) (Semester - V) Examination, November - 2016

ANTENNA & WAVE PROPAGATION

Sub. Code : 66314

Day and Date : Wednesday, 16 - 11 - 2016

Time : 02.30 p.m. to 05.30 p.m. **Total Marks : 100**

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) With the help of diagram explain the generation of field from oscillating dipole.

b) The normalized radiation intensity of a antenna is given by :

i) $U=\sin\theta\sin\phi$
ii) $U=\sin\theta\sin^2\phi$
iii) $U=\sin\theta\sin^3\phi$
iv) $U=\sin^2\theta\sin\phi$

$(0\le\theta\le\pi; 0\le\phi\le\pi)$ & zero elsewhere consider U = P(θ, ϕ)

Find Directivity in dB, exact & approximate.

c) The radiation intensity of an antenna is approximated by

$$U(\theta,\phi)=\begin{cases}\cos^4(\theta) & 0^\circ\le\theta\le90^\circ\\ 0 & 90^\circ\le\theta\le180^\circ\end{cases}$$ with $0^\circ\le\phi\le360^\circ$

Determine the maximum effective aperture (in m^2) of antenna if the frequency of operation is 10 GHz. Consider U (θ, ϕ) = P(θ, ϕ).

P.T.O.

Q2) Attempt any Two. [16]

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

b) Draw and explain infinite and finite biconical antennas.

c) Derive the equation for normalized electric field due to linear arrays of *n* - isotropic point sources of equal amplitude & spacing.

Q3) Attempt any Two. [18]

a) What is antenna impedance? Give experimental set up of antenna impedance measurement using

i) Wheatstone's Bridge method &

ii) Slotted line method

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

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

SECTION - II

Q4) Attempt any two.

a) With the help of Ez & Ep or Er, explain how Norton has reduced the complexicity of space waves & surface waves. [8]

b) A broadcast transmitter supplies 100kW to an antenna that radiates 50% of this power. The antenna has directional characteristics such that the field strength without ground losses is given by

$E_0 = 300 \times 1.28 \sqrt{PkW}$ mV/m at 1 km.

Find the field strength of ground wave at 100 km for the following types of earth conditions, for f = 500kHz. [8]

i) Cities, industrial areas $\Rightarrow \epsilon_r = 5$, $\sigma = 10^{-5}$ (mho)/cm

ii) Rocky soil $\Rightarrow \epsilon_r = 10$, $\sigma = 2 \times 10^{-5}$ (mho)/cm

c) Explain in detail wave tilt of surface waves. [8]

Q5) Attempt any two.

a) Explain in detail, Antenna scanning & Tracking techniques. [8]

b) With a CW transmitt frequency of 4GHz, calculate the Doppler frequency seen by a stationary radar when the target radial velocity is 100 km/h. [8]

c) Calculate maximum range of a radar system which operates at 3cm with a peak pulse power of 500 kW, if its minimum receivable power is 10^{-13}W, the capture area of its antenna is $5m^2$, and the radar cross-sectional area of target is $20m^2$. [8]

Q6) Attempt any three :

a) If the critical frequency of three different ionised layers is 180 kHz, 6.364 MHz & 12.8 MHz respectively, then find the electron density of each layer. [6]

b) Explain ionosphere and its regular & irregular variations. [6]

c) Explain effect of earth's magnetic field. [6]

d) Explain in detail reflection & refraction of wave by ionosphere. [6]