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Printed Pages—4 **EC—504**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 3007 **Roll No.** | | | | | | | | | | |

B.Tech.

FIFTH SEMESTER EXAMINATION, 2005-2006

ANTENNA AND WAVE PROPAGATION

Time : 2 Hours *Total Marks : 50*

Note : *(i) Answer **ALL** questions.*

(ii) All questions carry equal marks.

(iii) In case of numerical problems assume data wherever not provided.

(iv) Be precise in your asnwer.

1. Attempt ***any four*** of the following questions : **6x2**

(a) If the far field component E_θ for an oscillating electric dipole is $E_\theta = \frac{wIdl \sin\theta}{4\pi\epsilon u^2 r}$ prove that for the above mentioned dipole $\mu_\varphi = \frac{wIdl \sin\theta}{4\pi ur}$

(b) Derive an expression for the vector potential A_Z at a point P located at a large distance *r* from a half wave dipole placed along the Z-axis.

(c) What is end effect with reference to an antenna ? Due to this end effect what will be the nature of the input impedance (Real, inductive or capacitive) of a quarter wave monopole if its physical length is taken to be $\lambda/4$ and why ?

(d) The power delivered to an isotropic radiator is 1kW and the antenna efficiency is 90%. Find the electric field intensity at a distance of 100 km.

(e) Show that the effective area and effective length of an antenna are related by $A_{eft} = \frac{30\pi \ell^2_{eft}}{R_{rad}}$

(f) A directional antenna has an effective radiated power of 1.1kW, when it is fed with a terminal input power of 90 watts. The radiation resistance is 74Ω at resonance and the measured antenna current is 1.088 amperes r.m.s. Find -

(i) The antenna efficiency

(ii) The antenna power loss

(iii) The directive gain in decibels over an isotropic radiator

Attempt *any four* of the following questions : **6x2**

(a) Plot the array factor as a function of ϕ for a four element end fire array with $\lambda/4$ spacing.

(b) Specify the diameter of a parabolic reflector required to provide a gain of 55 dB at a frequency of 15 GHz. The area factor of the feed is 0.65. Also calculate the capture area of the antenna.

(c) Explain the antenna top loading and tuning.

(d) Explain the working of a resonant V antenna. Show how a bidirectional pattern in V antenna can be reduced to unidirectional pattern.

(e) What is beam mode of radiation in a helical antenna ? Calculate in dB the directivity of a helix antenna with 15 turns, having $\alpha = 10^\circ$ and circumference equal to one wavelength.

(f) How a horn produces a uniform phase front with a larger aperture in comparison to wave guide. Mention one antenna system when a horn is used as a feed system.

Attempt *any two* of the following questions : 6x2

(a) Explain how earth magnetic field affects the propagation of radio waves in the ionosphere. Discuss its effects on polarization of radio waves.

(b) Give reasons for the following :

(i) Why are AM broadcast stations often received at greater distances during the night than during the day ? Is this always an advantage ?

(ii) Sometimes an HF radio station can be heard at a distance of 1000 kms from the transmitter but can't be heard 100 km away, why ?

(iii) At noon a station can transmit from New York city to Miami at a frequency of 25MHz but not at 5MHz At mid might the situation is reversed. Why ?

c) State the undesirable effects that can be caused by reflection in line of sight communications. A microwave signal at 1.9GHz arrives at an antenna via two paths differing in length by 19m. Calculate :

(i) The difference in arrival time for the two paths.

(ii) Calculate the phase difference between the two signals.

4. Attempt *any two* of the following questions : 7x2

(a) Define and explain with reference it ionospheric propagation.

(i) Critical frequency

(ii) Critical angle

(iii) Maximum usable frequency

(iv) Optimum working frequency If the critical frequency for a layer is 12MHz, what is the critical angle at 15MHz.

(b) Explain the following fading phenomena :

(i) Selective fading

(ii) Interference fading

(iii) Polarization fading

(c) Explain the phenomenon of propagation that will be utilised in LORAN-C navigation beacons that are operated at 100KHz.

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