[ REVISED COURSE ]

CON/4394-05. PR-4850

( 3 Hours ) [ Total Marks : 100

N.B. : (1) Question No.1 is compulsory.
(2) Attempt any four from the remaining six questions.
(3) Figure to the right indicate full marks.
(4) Assume any suitable data whenever required.

1. a) Expain isotropic antenna , omnidirectional antenna and directional antenna. 03
b) Define directivity and gain of an antenna. Derive the relation between the two. 03
c) Explain the different types of antenna losses. 04
d) What is a magnetic dipole? Compare it with electric dipole. 04
e) An antenna having a gain of 6 db over a reference antenna is radiating 700 watts. Calculate the power the reference antenna must radiate in order to be equally effective in most preferred direction. 03
f) Compare traveling wave and standing wave antennas. 03

2. a) Derive the wave equation in terms of vector potential from Maxwell's equations. Also solve the wave equation for infinitesimal current source or current density $J_z$. 12
b) Find the expression for far electric field of a infinitesimal electric dipole placed vertically at a height 'h' over a perfect electric conducting plane. Draw the field pattern for h = 0. 08

3. a) Define beam solid angle , beam efficiency and resolution of an antenna. Find the number of radio transmitters distributed uniformly over the sky which an antenna can resolve in terms of directivity. 10
b) Normalised radiation intensity of an antenna is given by 10

$U = \sin\theta \sin\Phi \quad 0 \le \theta \le \Pi \ \& \ 0 \le \Phi \le \Pi$

$0 \quad$ elsewhere.

Find - i) Exact directivity.
ii) Azimuth and elevation plane HPBW in degrees.

4. a) Explain Friis transmission formula. A series of microwave repeater links operating at 10 Ghz are used to relay TV signals into a valley that is surrounded by steep mountain ranges. Each repeater consists of a receiver , a transmitter , antennas and associated equipment. The transmitting and receiving antennas are identical horns having a gain of 15 db. The repeaters are separated by 10 kms. For acceptable S/N ratio the power received at receiver must be greater than 10 nwatts. Loss due to polarization mismatch is 3db. Assume matched loads and free space propagation conditions. Determine the minimum transmitter power that should be used. 12
b) Derive the relation between the maximum effective aperture and maximum directivity of an antenna. 08

5. a) List the parameters that decide the overall pattern of an antenna array. 05
b) A broadside array consists of 4 isotropic sources with a distance of $\lambda/2$ between them. 15
Find - i) The array factor.
ii) Directions of major lobe and minor lobe maxima.
iii) Directions of minima.
iv) HPBW and FNBW.
v) First minor lobe level.
vi) Plot the pattern.

6. a) Explain the different types of feed systems for paraboloidal reflectors. Find FNBW and gain of paraboloidal reflector antenna of mouth diameter of 2 mts and operating at 6000mhz. 12
b) What is a folded dipole? Find its radiation resistance. Discuss its applications. 08

7. a) Explain the mechanism of ionospheric propagation. Define critical frequency, MUF and OWF. 10
b) A high frequency radiolink has to be established between two points at a distance of 2500kms on earth's surface. Considering the ionospheric height of 200kms and critical frequency of 5mhz, calculate MUF for given path. Derive the formula used. 10