EC- 504 **Roll No.** | | | | | | | | | | |

B.Tech.
(SEM V) ODD SEMESTER EXAMINATION2015-16
Antenna and Wave Propagation

[Time: 3 hrs.] **[Max. Marks: 100]**

Note- ***Attempt All Questions. All Questions carry equal marks*:-**

1. Attempt **any four** parts of the following. [4x5]

a) Define the term antenna aperture. Derive the equation for directivity in terms of aperture.

b) Explain the following terms with respect to antenna:
i) Field zones ii) Effective height.

c) Determine the directivity of the system if the radiation intensity
i) $U = U_m\cos^3\theta$ ii) $U = U_m\sin\theta \sin^2\phi$.

d) Derive a relation total received power and total transmitted power in terms of directivities.

e) Derive an expression for antenna efficiency in terms of radiation resistance.

f) An antenna has a directivity of 20 and a radiation efficiency of 90%. Compute the gain of the antenna in decibels.

2. Attempt **any four** parts of the following. [4x5]

a) State and prove the power theorem.

b) Explain the principle of pattern multiplication.

c) Derive an expression for array factor of an array of N- isotropic sources.

d) A linear antenna consists of 4 – isotropic sources. The distance between adjacent elements is $\frac{\lambda}{2}$. The power is applied with equal magnitudes and a phase differences –dr. Obtain the field pattern and find HPBW.

e) Prove that the width of main lobe of uniform end-fire array is broader than for a uniform broad side array.

f) Calculate the directivities in decibels for the following broadside arrays of point sources:
i) $N = 2, d = \lambda/2$ ii) $N = 10, d = \lambda/2$.

3. Attempt **any two** parts of the following. [2x10]

a) Write short notes on:
i) Long wire antenna ii) Folded dipole antenna.

b) i) A thin linear dipole antenna is $\lambda/12$ long and its loss resistance is 1.2 Ω. Find the radiation resistance and efficiency.
ii) How can we increase input impedance of Yagi-Uda antenna without affecting other parameters?

c) Write short note on:
i) Image Theory ii) Equivalence principle.

4. Attempt **any two** parts of the following. [2x10]

a) Derive the following expression for circular loop antenna with constant current.

$$A_\phi = j\,\frac{a\mu I_0 e^{-jkr}}{2r}\,J_1(ka\sin\theta)$$

b) What is Microstrip antenna. Explain different excitation techniques.

c) Describe a Helical Antenna.Explain its two modes of operation with relavant expressions.

5. Attempt **any two** parts of the following. [2x10]

a) i) Discuss the effect of Earth's magnetic field on Ionospheric propagation.

ii) A high frequency radio link has to be established between two points on the earth 200 Km away. The reflectionregion of the ionosphere is at a height of 200Km and has a critical frequency of 6 MHz. Calculate the MUF for thegiven path in case of flat earth.

b) Explain the mechanism of Ionospheric propagation. Also derive an expression for the refractive index of an Ionospheric layer.

c) Define the terms

i) Critical frequency f_c

ii) Skip diatance D_{skip}

iii) Maximum usable frequency f_{MUF}

iv) Virtual Height.