

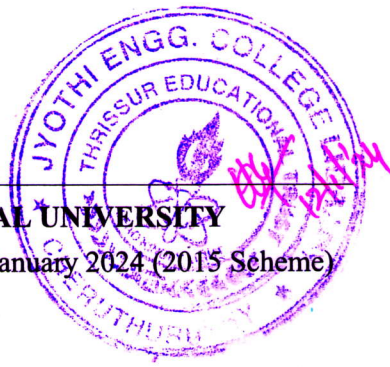
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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech Degree (S, FE) Examination January 2024 (2015 Scheme)



Course Code: EC306

Course Name: Antenna & Wave Propagation

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer any two full questions, each carries 15 marks*

Marks

- 1 a) Derive the expressions for far field components of electric and magnetic fields of a half wave dipole. (10)
- b) The radial component of radiated power density of an antenna is given as  $W_{rad} = \frac{A_0 \sin^2 \theta}{r^2} \cdot a_r$ . Find its directivity. (5)
- 2 a) Define effective length of a receiving antenna. Derive the expression for effective length in terms of effective aperture and radiation resistance. (5)
- b) The expression for magnetic field due to a small current element 'dl' at a distance 'r' from it is given by  $H_{\phi} = \frac{I_m dl \sin \theta}{4\pi} \left[ \frac{-\omega \sin \omega t_1}{cr} + \frac{\omega \cos \omega t_1}{r^2} \right]$ . Identify near field and far field components. Also calculate the distance at which both near and far field components becomes equal. (5)
- c) Let there be two antennas A & B whose directivities and maximum effective apertures are denoted by  $D_a$ ,  $D_b$  and  $(A_{ea})_{max}$ ,  $(A_{eb})_{max}$  respectively. How these are related together? If antenna A is isotropic antenna, derive the equations to calculate  $(A_{ea})_{max}$  and  $D_b$ . (5)
- 3 a) Explain the method used to measure impedance of an antenna which operates at a frequency i) below 30 MHz  
ii) above 1000 MHz (8)
- b) An antenna has a radiation resistance of  $72 \Omega$ , a loss resistance of  $18 \Omega$  and a power gain of 12 dB. Determine the antenna efficiency and directivity. (7)

**PART B**

*Answer any two full questions, each carries 15 marks*

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- 4 a) Design an array of  $n$  isotropic sources of equal amplitude and spacing (end fire case). (10)  
Find the directions of pattern maxima and minima for  $n=4$  and spacing =  $\lambda/2$ .
- b) Explain Cassegrain antenna and state any two advantages of it. (5)
- 5 a) Explain Dolph– Tchebyshev array. How optimum pattern can be obtained using (10)  
Tchebyshev polynomial.
- b) Explain parabolic dish antenna. Draw its diagrams on transmitting and (5)  
receiving mode.
- 6 a) Which antenna has the shape of a rhombus? Draw the diagram and explain the (10)  
construction and working along with the design parameters
- b) Explain the principle of pattern multiplication with a suitable example. (5)

**PART C**

*Answer any two full questions, each carries 20 marks*

- 7 a) Explain the structure of log periodic antenna. Name its regions of operations (10)  
and explain each of them briefly.
- b) What is super refraction? Explain how it happens in atmospheric duct with the (10)  
help of necessary diagrams
- 8 a) Explain patch antenna. State the patch parameters and explain the feeding (15)  
techniques.
- b) Explain ground wave propagation? State any two disadvantages. (5)
- 9 a) What is meant by space wave propagation? Derive the expressions for line of (15)  
sight distance and field strength at a distance for space wave propagation.
- b) Explain base station antennas and handset antennas. (5)

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