Printed Pages3 **Roll. No.** | | | | | | | | | | | **Sub Code: NEC 504**

Paper ID:3053

B. TECH. (REGULAR & CARRY OVER)
(SEM. V) THEORY EXAMINATION 2017-2018
ANTENNA AND WAVE PROPAGATION

Time: 3 Hours ***Total Marks:100***

Note: Attempt all questions. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 × 10 = 20

(a) Explain half power beam width and first null beam width.

(b) Explain the concept of point sources.

(c) Explain antenna temperature in brief.

(d) What is tapering? Explain it with suitable example.

(e) The radiation resistance of an antenna is 72 Ω and loss resistance is 8 Ω. What isthe directivity in dB if the power gain is 16.

(f) A uniform linear array consists of 20 isotropic point sources with a spacing of λ/4 if the phase difference is –90˚. Calculate its HPBW and directivity.

(g) For a parabolic reflector having directivity of 30 dB and an aperture efficiency of 55 % operating at 15 MHz.Calculate the area of parabolic reflector and HPBW.

(h) Find the power gain and directivity of a horn whose dimensions are 10 cm × 5 cm and operating at a frequency of 6 GHz.

(i) Define skip distance and virtual height.

(j) A microwave signal of 1.9 GHz arrives at an antenna via two paths differing in length by 19 m. Calculate (i) the difference in arrival time for the two paths (ii) phase difference between the two signals.

SECTION B

2. Attempt any *three* of the following: 10 × 3 = 30

(a) What is Antenna gain, Directivity, Beam efficiency, and Antenna Impedance?

(b) Explain the linear array of n isotropic point sources of equal amplitude and spacing. Derive the expressions of direction of pattern maxima, direction of minimum field pattern, beam width of major lobe and directivity for a broadside array of n isotropic sources.

(c) Derive the expressions of potential, electric and magnetic field of a short electric dipole.

(d) Describe the principle of direction finding by means of a closed loop antenna and give the expression for the induced voltage and field strength for short loop and large loop.

(e) Explain the following-

(i) Atmospheric noise

(ii) Maximum usable frequency

(iii) Critical frequency

(iv) Skip distance in a short wave communication

SECTION C

3. Attempt any *two* of the following: 5 × 2 = 10

(a) Explain the antenna efficiency. A directional antenna has an effective radiated power of 1.1 kW, when it is fed with a terminal input power of 90 W. Radiation resistance is 74 Ω at resonance and measured antenna current is 1.088 ampere rms. Find (i) The antenna efficiency, (ii) The antenna power loss, (iii) The directive gain in decibels over an isotropic radiator.

(b) Write short notes on the following-

(i) Directivity and Resolution.

(ii) The Radio Communication Link

(c) Explain the antenna aperture in detail and also derive an expression showing the relation between effective aperture and directivity of an antenna.

4. Attempt any *two* of the following: 5 × 2 = 10

(a) Derive the total far field for an array of two isotropic point sources of equal amplitude and phase. Find out the maximum, minimum and half power point directions of radiation pattern for this case.

(b)What is Yagi-Uda Antenna? Explain its construction and properties with special reference to directivity and bandwidth.

(c) Explain the Thin Linear Antenna and also derive the radiation resistance of λ/2 antenna.

5. Attempt any *two* of the following: 5 × 2 = 10

(a)What is helical antenna and explain different type of feed method for parabolic reflector.

(b) Write the short note on log periodic antenna with proper mathematical expression.

(c) Explain the slotantenna used in communication with its application.

6. Attempt any *two* of the following: 5 × 2 = 10

(a) What are the two modes of radio propagation? Discuss the space wave propagation.

(b) What do you understand by plane earth reflection? Derive the formulas of reflection coefficient for horizontal polarization and reflection coefficient for vertical polarization.

(c) What is the role of ionosphere in propagation? How do reflection and refraction occur?

7. Attempt any *two* of the following: 5 × 2 = 10

(a)Explain the principle of pattern multiplication. Synthesize the pattern using this principle for the two cases- (i) Four isotropic elements spaced λ/2 apart and fed in phase. (ii) Eight isotropic elements spaced λ/2 and fed in phase.

(b) Define Directive gain and power gain in detail and also explain the difference between them.

(c) How a horn antenna produces a uniform phase front with a large aperture in comparison to waveguide? Mention one antenna system when a horn is used as a feed system.