

**GUJARAT TECHNOLOGICAL UNIVERSITY**

**BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2024**

**Subject Code:2161003**

**Date:17-05-2024**

**Subject Name:Antenna & Wave Propagation**

**Time:10:30 AM TO 01:00 PM**

**Total Marks:70**

**Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

|            |                                                                                                                                                                                               | MARKS     |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Q.1</b> | <b>(a)</b> Explain the following antenna parameter<br>(i ) Radiation Pattern (ii) Antenna efficiency (iii) HPBW                                                                               | <b>03</b> |
|            | <b>(b)</b> The radiation intensity of a unidirectional antenna is<br>$U=U_m \cos \theta, 0 \leq \theta \leq \pi/2, 0 \leq \phi \leq 2\pi.$<br>find exact directivity of antenna.              | <b>04</b> |
|            | <b>(c)</b> Define antenna and enlist its function. Compare antenna and transmission line.                                                                                                     | <b>07</b> |
| <b>Q.2</b> | <b>(a)</b> What is radiation resistance of antenna, what are the importance of radiation resistance.                                                                                          | <b>03</b> |
|            | <b>(b)</b> Justify the statement “ the directivity of antenna is equal to the number of point source that the antenna can resolve.”                                                           | <b>04</b> |
|            | <b>(c)</b> Define oscillating dipole. Derive the E and H field component due to oscillating dipole in spherical coordinate system.                                                            | <b>07</b> |
|            | <b>OR</b>                                                                                                                                                                                     |           |
|            | <b>(c)</b> Derive the expression for radiated power and radiation resistance of a small current element. Find radiation resistance of a hertzian dipole of length $\lambda/10$ .              | <b>07</b> |
| <b>Q.3</b> | <b>(a)</b> Explain principle of pattern multiplication for array of point source.                                                                                                             | <b>03</b> |
|            | <b>(b)</b> Write short note on horn antenna                                                                                                                                                   | <b>04</b> |
|            | <b>(c)</b> Discuss the use of Dolph-Tchebysheff distribution and polynomials in detail in antenna array design.                                                                               | <b>07</b> |
|            | <b>OR</b>                                                                                                                                                                                     |           |
| <b>Q.3</b> | <b>(a)</b> A circular loop antenna has a diameter $1.5 \lambda$ . find its directivity and radiation resistance.                                                                              | <b>03</b> |
|            | <b>(b)</b> For helical antenna discuss briefly normal mode and axial mode of operation.                                                                                                       | <b>04</b> |
|            | <b>(c)</b> Derive the expression for two isotropic point source of the same amplitude and (i ) opposite phase (ii ) inphase quadrature phase, feed currents and sketch the radiation pattern. | <b>07</b> |

- Q.4** (a) Describe nonmetallic dielectric lens antenna. **03**  
(b) Explain the construction and working principle of microstrip antenna. **04**  
(c) What is slot antenna and where it is used? State babinets principle and illustrate its application to slot antenna. **07**

**OR**

- Q.4** (a) Write short note on paraboloidal antenna. **03**  
(b) Design a three element yagi uda antenna to operate at a frequency of 172 MHz. **04**  
(c) Derive expression for radiation resistance of loop antenna. **07**

- Q.5** (a) Explain gain transfer method for gain measurement. **03**  
(b) Write short note on UWB. **04**  
(c) Explain MUF, critical frequency and skip distance with necessary equation. **07**

**OR**

- Q.5** (a) Write short note on phase measurement method of antenna **03**  
(b) Write short note on frequency independent antenna. **04**  
(c) Explain duct propagation and tropospheric scattering in details. **07**

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