**20EC502**

**Hall Ticket Number:**

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| **III/IV B.Tech (Regular) DEGREE EXAMINATION** | | | |
| **February,2023** | **Electronics & Communication Engineering** | | |
| **Fifth Semester** | **Antennas & Wave Propagation** | | |
| **Time:** Three Hours | | **Maximum: 7**0 Marks | |
| *Answer Question No. 1 Compulsorily.* | | | (14X1 = 14 Marks) |
| *Answer* ***ANY ONE*** *question from each Unit.* | | | (4X14=56 Marks) |

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| 1. | a) | What is dipole antenna? | CO1 | L1 | 1M |
|  | b) | Define radiation field. | CO1 | L1 | 1M |
|  | c) | What is quarter wave monopole? | CO1 | L1 | 1M |
|  | d) | What is meant by isotropic radiator? | CO2 | L1 | 1M |
|  | e) | Define radiation intensity. | CO2 | L1 | 1M |
|  | f) | What are the disadvantages of binomial array? | CO3 | L1 | 1M |
|  | g) | Define array factor. | CO3 | L1 | 1M |
|  | h) | List the applications of helical antenna. | CO4 | L1 | 1M |
|  | i) | What are the advantages of folded dipoles? | CO4 | L1 | 1M |
|  | j) | List the applications of micro strip antenna. | CO4 | L1 | 1M |
|  | k) | What are the different types of wave propagation? | CO5 | L1 | 1M |
|  | l) | What is meant by wave tilt in ground wave propagation? | CO5 | L1 | 1M |
|  | m) | Define critical frequency. | CO5 | L1 | 1M |
|  | n) | Define Maximum Usable Frequency. | CO5 | L1 | 1M |
| **Unit -I** | | | | | |
| 2. | a) | Explain potential functions using heuristic approach. | CO1 | L2 | 7M |
|  | b) | Derive the magnetic field components of an alternating current element. | CO1 | L4 | 7M |
|  |  | **(OR)** |  |  |  |
| 3. | a) | Explain antenna radiation mechanism. | CO1 | L2 | 7M |
|  | b) | Derive the expression for power radiated by a half wave dipole antenna. | CO1 | L4 | 7M |
|  |  | **Unit -II** |  |  |  |
| 4. | a) | Define the terms radiation pattern, gain and directivity of an antenna. | CO2 | L1 | 7M |
|  | b) | Distinguish between broadside array and end fire array. | CO3 | L4 | 7M |
|  |  | **(OR)** |  |  |  |
| 5. | a) | Derive the relation between maximum effective aperture and directivity. | CO2 | L4 | 7M |
|  | b) | Explain the principle of pattern multiplication with an example. | CO3 | L2 | 7M |
|  |  | **Unit -III** | |  |  |
| 6. | a) | Explain in detail about Rhombic Antenna with a neat sketch. List the advantages & applications. | CO4 | L3 | 7M |
|  | b) | Discuss in detail about slot antenna. | CO4 | L2 | 7M |
|  |  | **(OR)** |  |  |  |
| 7. | a) | Explain the operation of Yagi-Uda array with a neat sketch. | CO4 | L2 | 7M |
|  | b) | Calculate the beam width between first null and power gain of a 2 m paraboloid reflector operating at 6 GHz. | CO4 | L3 | 7M |
|  |  | **Unit -IV** |  |  |  |
| 8. | a) | Describe the important features of space wave propagation. | CO5 | L2 | 7M |
|  | b) | Discuss the phenomenon of duct propagation briefly. | CO5 | L2 | 7M |
|  |  | **(OR)** |  |  |  |
| 9. | a) | What is a radio horizon? Derive the expression for radio horizon. | CO5 | L4 | 7M |
|  | b) | Explain the phenomenon of refraction and reflection of sky wave by ionosphere. | CO5 | L2 | 7M |

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**Scheme of valuation**

1(a) Dipole antenna - 1 Mark

(b) Radiation field - 1 Mark

(c) Quarter-wave monopole - 1 Mark

(d) Isotropic radiator - 1 Mark

(e) Radiation intensity - 1 Mark

(f) Disadvantages of binomial array - 1 Mark

(g) Array factor - 1 Mark

(h) Applications of helical antenna - 1 Mark

(i) Advantages of folded dipoles - 1 Mark

(j) Applications of micro strip antenna - 1 Mark

(k) Different types of wave propagation - 1 Mark

(l) Wave tilt - 1 Mark

(m) Critical frequency - 1 Mark

(n) Maximum Usable Frequency - 1 Mark

2(a) Potential functions using heuristic approach - 7 Marks

(b) Diagram - 2 Marks

Magnetic field components derivation - 5 Marks

3(a) Diagrams - 2 Marks

Explanation - 5 Marks

(b) Diagram - 2 Marks

Power radiated by half wave dipole derivation - 5 Marks

4(a) Radiation pattern, - 3 Marks

Gain - 2 Marks

Directivity - 2 Marks

(b) Any three differences - 7 Marks

5 (a) Maximum effective aperture and directivity derivation - 7 Marks

(b) Principle of pattern multiplication - 2 Marks

Explanation with an example - 5 Marks

6 (a) Formulas - 4 Marks

Calculation Part - 3 Marks

(b) Slot antenna diagram - 2 Marks

Explanation - 5 Marks

7 (a) Diagram - 2 Marks

Operation of Yagi-Uda array - 5 Marks

(b) Calculation of beam width between first null - 3 Marks

Calculation of power gain - 4 Marks

8(a) Features of space wave propagation - 7 Marks

(b) Duct Propagation - 7 Marks

9(a) Radio Horizon - 1 Mark

Derivation - 6 Marks

(b) Refraction and reflection of sky wave by ionosphere - 7 Marks

**Solutions -Numerical Problems**

Q. No. 6(a) Design a Rhombic antenna to operate at 20MHz when the angle of elevation ∆= 100

Sol:

Tilt angle, φ =

λ

At MHz

m

m

m

Q. No. 7(b) Calculate the beam width between first null and power gain of a 2 m paraboloid reflector operating at 6 GHz.

Sol:

Given Data

GHz

m

m

db