| Reg. No. | | | | | | | | | | | | |
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| Question Paper Code | 21321 |
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**M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022**

First Semester

**M.E. - Communication Systems**

**20PCOPC101 - ADVANCED RADIATION SYSTEMS**

(Regulations 2020)

Duration: 3 Hours | Max. Marks: 100

**PART - A (10 × 2 = 20 Marks)**

Answer ALL Questions

| | | *Marks, K-Level, CO* |
|---|---|---|
| 1. | State Huygen's principle. | *2,K1,CO2* |
| 2. | List the merits and demerits of offset feed reflector antenna. | *2,K1,CO2* |
| 3. | Differentiate FNBW and HPBW. | *2,K1,CO3* |
| 4. | The phased array called as the scanning array. Prove the statement using suitable formula. | *2,K2,CO3* |
| 5. | Describe the radiation mechanism of microstrip dipole antenna. | *2,K1,CO4* |
| 6. | List the applications of microstrip array antenna. | *2,K1,CO4* |
| 7. | List the antenna configurations used in base stations. | *2,K1,CO5* |
| 8. | State the suitable location of antenna on a regular passenger car. | *2,K1,CO5* |
| 9. | Outline the features of an anechoic chamber and mention its uses. | *2,K2,CO6* |
| 10. | Demonstrate the instruments required to accomplish an antenna measurement task. | *2,K1,CO6* |

**PART - B (5 × 13 = 65 Marks)**

Answer ALL Questions

| | | | |
|---|---|---|---|
| 11. | a) | Describe in detail the field equivalence principle and derive radiation equations for aperture antenna. | *13,K1,CO2* |
| | | **OR** | |
| | b) | Derive the electric and magnetic field equations for a rectangular aperture on an infinite ground plane. | *13,K1,CO2* |
| 12. | a) | Derive the expression for antenna array factor for a N-element array. Explain its significance. | *13,K1,CO3* |
| | | **OR** | |
| | b) | Derive the parameters of broadside array, end fire array and Hansen – Woodyard array and compare the expressions obtained. | *13,K1,CO3* |

13. a) Using suitable diagram and equations, explain the design procedure involved in the Microstrip array and feed network design. *13,K1,CO4*

**OR**

b) Derive and explain the rectangular patch antenna in transmission line model. *13,K1,CO4*

14. a) (i) Analyze the Principles and requirements of UWB antenna and discuss its characterization parameters. *6,K1,CO5*

(ii) Interpret the features of Vivaldi antenna. *7,K1,CO5*

**OR**

b) Discuss the operation and applications of antenna

(i) PIFA antenna *6,K1,CO5*

(ii) Automobile antennas. *7,K1,CO5*

15. a) Assess the nature of absorbing material and the anechoic chamber. Explain the design aspect of anechoic chamber *13,K2,CO6*

**OR**

b) (i) With neat diagrams, explain how transmitter and receiver antenna factors are measured. *7,K1,CO6*

(ii) Discuss the issues related to EMC in detail. *6,K1,CO6*

**PART - C (1 × 15 = 15 Marks)**

16. a) (i) The normalized radiation intensity of an antenna is represented by $U=\text{Cos}^2\theta\ \text{Cos}^2(3\theta)$, $(0 \leq \theta \leq 90^o, 0 \leq \emptyset \leq 360^o)$. Find the half-power beam width and first-null beam width in radians and degrees. *8,K2,CO1*

(ii) The radial component of the radiated power density of an antenna is given by $W_{rad}=\mathbf{a}_r A_0 \sin\theta/r^2$ $W/m^2$, find the maximum directivity of the antenna. Write an expression for the directivity as a function of the directional angles and $\emptyset$. *7,K2,CO1*

**OR**

b) (i) The radiation intensity of an antenna is given by $U(\theta,\emptyset)=B_0 \text{Sin}\theta \text{Sin}^2\emptyset$, $0 \leq \theta \leq \pi$, $0 \leq \emptyset \leq \pi$, and 0 elsewhere. *10,K1,CO1*

(ii) Determine the maximum directivity using numerical techniques. Compare it with the exact value. *5,K2,CO1*