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National Institute of Technology, Hamirpur (HP)


Name of Examination: B.Tech./DD End Semester Examination (May-2023)

Branch: ECE
Subject: Antenna and Wave Propagation
Time: 3 Hours

Semester: VI
Subject Code: EC-324
Maximum Marks: 50

## Note:

$>$ All questions are compulsory.
$>$ Use of scientific calculator is permitted
$>$ Assume missing data.
Q. 1 What are the retarded potentials and advanced potentials? How is the vector potential A useful in solving for the EM field generated by a given harmonic electric current $J$ ?
[5M]
Q. 2 Write the current distribution of a linear dipole of finite length. Show that the total field of the antenna is equal to the product of the element and space factors.
[SM]
Q. 3 A voltage source of amplitude $\mathrm{Vg}=(50+\mathrm{j} 40) \mathrm{V}$ and a source impedance $\mathrm{Zg}=50 \Omega$ is connected to an antenna having a radiation resistance $\mathrm{R}_{\mathrm{rad}}=70 \Omega$, loss resistance $\mathrm{R}_{\text {loss }}=1 \Omega$, and a reactance $\mathrm{jX}=\mathrm{j} 25 \Omega$. Calculate the radiation efficiency of the antenna, the real power delivered by the source, the real power input to the antenna, power radiated by the antenna, and the power dissipated in the antenna.
[10M]
Q. 4 Evaluate the antenna factor, nulls and principal maxima of n-element linear array with uniform amplitude and spacing. Also explain broadside and ordinary end-fire array.
[10M]
Q. 5 Explain the working principle of microstrip antenna with suitable diagram. What are the different feed techniques for excitation of microstrip antennas? Mention with suitable diagram.
[SM]
Q. 6 How is the step-up impedance by a factor of 4 is achieved with the folded dipole antenna? Show with proper explanation and mathematics.
[SM]
Q. 7 How do the electromagnetic waves propagate, explain with suitable diagram? Discuss the factors that affect the propagation of EM waves through different paths.
Q. 8 A free-space LOS microwave link operating at 10 GHz consists of a transmit and a receive antenna each having a gain of 25 dB . The distance between the two antennas is 30 km and the power radiated by the transmit antenna is 10 W . Calculate the path loss of the link and the received power.
[SM]

