M.E. ELECTRONICS AND TELE-COMMUNICATION ENGINEERING
FIRST YEAR
SECOND SEMESTER EXAM 2018

ADAPTIVE AND SMART ANTENNA (MW)

Time: Three hours Full Marks:100

[*Answer any five questions*]

1. a) List all major challenges of wireless communication systems. How to combat these challenges using smart antennas? How does a smart antenna system behave with SNOI and SOI. How such system detects DOA? [3+3+2+2]

   b) Explain switched beam steering techniques using schematic diagrams. Draw schematic diagram of a 4 x 4 Butler matrix and explain its operations. [5+5]

2. a) Draw the system block diagram of SDMA and explain its operations. What are the main benefits and major disadvantages of SDMA? [8+2]

   b) Draw and explain the functional block diagrams of smart antenna transmitter and receiver architectures. [10]

3. a) Calculate the uniform linear array beam patterns for 4-element arrays with $d = 0.5\ \lambda$. [4]

   b) Describe Null Synthesis technique using the unit circle. Explain Null Synthesis using cancellation of beams. [5+5]

   c) For a 5-element adaptive array, find out the necessary conditions for minimizing the noise interference from a particular direction. [6]

4. "Gradient algorithms are popular, because they are simple, easy to understand, and solve a large class of problems." - Explain with examples. Describe Least mean square (LMS) algorithm using pseudo-codes. Write suitable pseudo-code for the Constant-Modulus (CM) algorithm. [4+12+4]

5. a) How will you design a switchable microsirip antenna which can be switched using PIN diodes to operate at two different frequencies? Draw and explain the required biasing network. [4+4]

   b) How will you design a reconfigurable two element microstrip antenna array using MEMS for changing its polarization? Explain using microstrip layouts. [8]

c) How a patch with edges made from variable conductivity material can be used as reconfigurable antenna? Explain the use of photo conductive material in reconfigurable antennas. [2+2]

6. a) Explain optimum array processing techniques for narrow-band applications. [5]
b) Using block diagrams and mathematical expressions, explain the "MV performance measure". [12]
c) Write functional differences between "MSE performance measure" and "MV performance measure" [3]

7. Write short notes on: [4x5=20]
(a) Compensation of mutual coupling in adaptive arrays
(b) Low side-lobe amplitude tapers and thinned arrays
(c) Nulling limitations due to miscellaneous array effects
(d) Sonar Technology