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| Course Title | Antenna Theory & Design | Couse Code | EE 528 |
| Credit Hours | 3 | Contact Hours | 3 |
| Semester | Spring 2019 | Session | -- |
| Instructor | Dr-Ing. Farooq Mukhtar | Contact | [mukhtar.farooq@uet.edu.pk](mailto:mukhtar.farooq@uet.edu.pk) |
| Lecture Schedule | Mon: 7:30- 9:00,  Fri: 4:30-6:00 | Office Schedule | Through appointment |

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| **Course Description** | 1. Antenna parameters, directivity and gain, beam-width, polarization, effective area of antenna, Friis transmission equation, antenna temperature and radar cross-section. 2. Radiation integral and potential functions, far field approximation, reciprocity and reaction theorem, equivalence of transmitting and receiving patterns. 3. Wire Antennas: Dipole, Loop and Helical antennas. 4. Aperture antennas, field equivalence principle, radiation patterns of wave guide open end and horn antenna, Microstrip antenna and arrays, reflector antenna. 5. Antenna arrays, linear and planar arrays, principle of pattern multiplication, uniform and tapered amplitude excitation, broadside end-fire and scanned arrays. Sum and Difference patterns. Schelkunoff’s unit circle for pattern control. 6. Reconfigurable antennas, overview of reconfiguration mechanisms for antennas, analysis of reconfigurable antennas | | | | | | |
| **CLOs** | **CLO1**: Apply basic parameters of antenna and target to interpret the behavior of antenna systems. | | | | | PLO1,M | Cog3 |
| **CLO2**: Analyze given antennas under valid approximations | | | | | PLO2, H | Cog4 |
| **CLO3**: Design the antenna system for given specifications. | | | | | PLO3,L | Cog5 |
| **Course Educational Outcomes** | The topics covered include: radiation by simple sources, antenna parameters and characterization properties, radiation pattern, radiation power density, radiation intensity, directivity, gain efficiency, beamwidth, bandwidth, polarization, input impedance, effective aperture, antenna temperature,. Friis transmission equation and radar equation, review of Maxwell’s, equations boundary conditions, Vector and Hertz potentials, radiation integral duality, reciprocity, elementary antennas; half-dipole, loop antennas, linear and planar arrays, phased arrays, phased arrays, endfire arrays, self and mutual impedance, broadband antennas, matching techniques traveling wave and aperture antennas, equivalence principle and horns. | | | | | | |
| **Text-Book** | Antenna Theory: Analysis and Design, by Constantine A. Balanis, John Wiley, 4th Edition, 2016  Recommended Text: Antenna Theory and Design by W L Stutzman and G A Thiele, 1997 | | | | | | |
| **Grading Policy** | Assignments  Class Participation | 60 %  0% | Quiz 1  Quiz 2 | 10 %  10 % | Mid Exam  Final Exam | 10 %  10 % | |

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| Week | Topics | Assignments | CLO | Reading |
| **1** | Introduction | 2D, 3D Polar plots | CLO1 | Ch. 1 |
| **1,2** | Antenna Basics, Parameters |  | CLO1 | Ch. 2 |
| **3** | EM Theory, Basics of analysis and Vector potentials |  | CLO2 | Ch.3 |
| **4** | Linear antennas, Infinitesimal dipole, half dipole, loop antenna | HFSS simulation | CLO2 | Ch.4,5 |
| **5,6** | Arrays, linear, circular, planar | Matlab codes for array patterns | CLO2 | Ch.6 |
| **7** | Antenna Measurement |  | CLO1 | Ch.17 |
| **8,9** | Mid Exams |  |  |  |
| **10** | Schelkunoff’s unit circle method | Design problem | CLO3 | Ch.7 |
| **11** | Log periodic/ Fractal Antennas | HFSS simulation | CLO1 | Ch.11 |
| **12,13** | Aperture Antennas, Horn Antennas | HFSS simulation | CLO2 | Ch.12,13 |
| **14,15** | Microstrip Antennas | HFSS simulation/ Design | CLO2/3 | Ch.14 |
| **16** | Reflector Antennas | HFSS simulation | CLO2 | Ch.15 |
| **17,18** | Final Exams |  |  |  |