Ain Shams University
Faculty of Engineering
*Electronics and Communications Department*
**Undergraduate, Electrical Engineering**

***Spring 2022***

# ECE353: Wireless Communication Networks - Course Project

**(A)** It is required to design using MATLAB, a simple planning tool for a service provider that owns 340 channels in the 900 MHz band. Your code should ask for the GOS, city area, user density, $SIR_{min}$ and sectorization method. Assume blocked calls are cleared in this system. Then, it should produce the following design parameters:

1) Cluster Size.
2) Number of cells.
3) Cell radius.
4) Traffic intensity per cell, and traffic intensity per sector.
5) Base station transmitted power.
6) A plot for the MS received power in dBm versus the receiver distance from the BS.

*In your design,* use the Hata model and assume urban-medium city (You can check outdoor propagation models). Let the effective heights of BS and MS equal 20 and 1.5 meters, respectively. Assume MS sensitivity equals $-95\ dBm$, the traffic intensity per user equals 0.025 Erlang and the path loss exponent equals 4.

**(B)** To validate your planning tool and understand the trade-offs between different design parameters it is required for a city area equal to $100\ km^2$ to deliver the following figures ***with reasonable comments***. Each figure should contain three curves for omni-directional, 120° sectorization and 60° sectorization designs.

1) Plot the cluster size versus $SIR_{min}$ with range from $1dB\ to\ 30\ dB$.

2) For $SIR_{min} = 19dB$ & user density= 1400 $users/km^2$,
   (i) Plot the number of cells versus GOS (1% to 30%).
   (ii) Plot the traffic intensity per cell versus GOS (1%to 30%).

3) At $SIR_{min} = 14dB$ & user density= $1400\ users/km^2$,
   (i) Plot the number of cells versus GOS (1% to 30%).
   (ii) Plot the traffic intensity per cell versus GOS (1% to 30%).

4) At $SIR_{min} = 14dB$ & GOS= 2%,
   (i) Plot the number of cells versus user density (100 to 2000 $users/km^2$).
   (ii) Plot the cell radius versus user density (100 to 2000 $users/km^2$).

5) At $SIR_{min} = 19dB$ & GOS= 2%,

(i) Plot the number of cells versus user density (100 to 2000 $users/km^2$).

(ii) Plot the cell radius versus user density (100 to 2000 $users/km^2$).

**Deliverables:**

Please submit a *soft-copy* of the following items:

- All MATLAB codes that produce (**A**) and (**B**). These codes have to be clear enough to be understood by the reader (for example, you have to use indicative variable names and use comments if required)
- A short report explaining the procedure you used along with the mathematical equations. The report should also include all the figures generated by your code and your comments on each figure.

**Project rules:**

- **4 students** per project.
- Project deadline is on ***Tuesday 24/5/ 2022 at 11:59 PM***.
- Late projects will be refused, and repeated reports will be canceled ***with a penalty***.
- The project will be **submitted on LMS**.

**Helpful note:**

The MATLAB command `[fzero]` could be helpful to relate between the GOS, traffic intensity and number of channels.