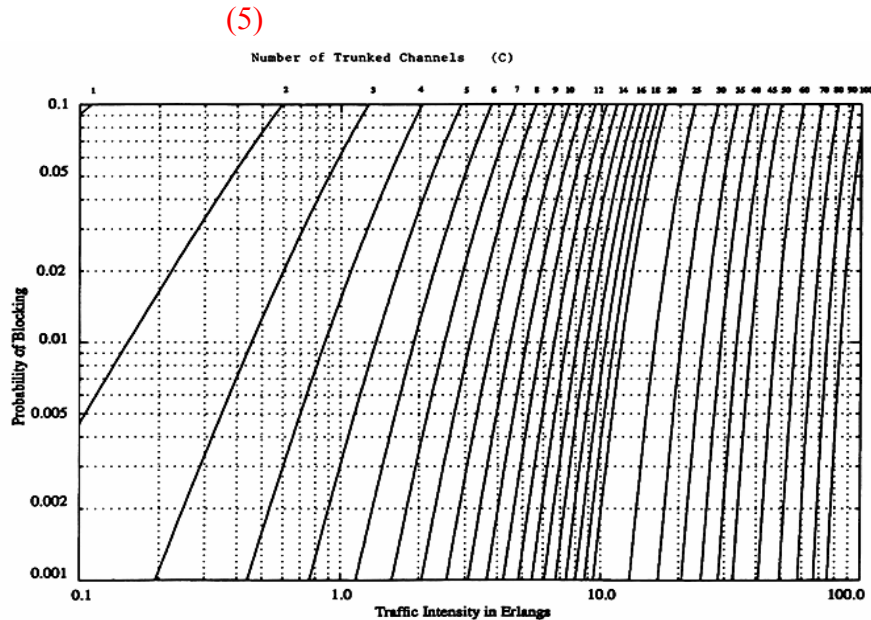


ASSIGNMENT I – 25 Marks

1. If a signal to interference ratio of 15 dB is required for satisfactory forward channel performance of a cellular system, what is the frequency reuse factor and cluster size that should be used for maximum capacity if the path loss exponent is (a) $n = 4$, (b) $n = 3$? Assume that there are 6 co-channels cells in the first tier, and all of them are at the same distance from the mobile. Use suitable approximations. (5)
2. An urban area has a population of 2 million residents. Three competing trunked mobile networks (systems A, B, and C) provide cellular service in this area. System A has 394 cells with 19 channels each, system B has 98 cells with 57 channels each, and system C has 49 cells, each with 100 channels. Find the number of users that can be supported at 5% blocking if each user averages 2 calls per hour at an average call duration of 3 minutes. Assuming that all three trunked systems are operated at maximum capacity, compute the percentage market penetration of each cellular provider. (The graph below can be used)



3. A certain city has an area of 1,300 square miles and is covered by a cellular system using a 7-cell reuse pattern. Each cell has a radius of 4 miles and the city is allocated 40 MHz of spectrum with a full duplex channel bandwidth of 60 kHz. Assume a GOS of 2% for an Erlang B system is specified. If the offered traffic per user is 0.03 Erlangs, compute (a) the number of cells in the service area, (b) the number of channels per cell, (c) traffic intensity of each cell, (d) the maximum carried traffic; (e) the total number of users that can be served for 2% GOS, (f) the number of mobiles per channel, and (g) the theoretical maximum number of users that could be served at one time by the system. (The graph ABOVE can be used)

(5)

4. A total of 24 MHz of bandwidth is allocated to a particular FDD cellular telephone system that uses two 30 kHz simplex channels to provide full duplex voice and control channels. Assume each cell phone user generates 0.1 Erlangs of traffic. Assume Erlang B is used.
(a) Find the number of channels in each cell for four cell reuse system. (2)

(b) If each cell is to offer capacity that is 90% of perfect scheduling, find the maximum number of users that can be supported per cell where omnidirectional antennas are used at each base station.

(2)

(c) What is the blocking probability of the system in (b) when maximum users are available in the user pool? (2)

(d) If each cell now uses sectoring instead of omnidirectional for each base station, what is the new total number of users that can be supported per cell for same blocking probability as in (c)? (2)

(e) If each cell covers five square kilometres then how many subscribers could be supported in an urban market that is $50 \text{ km} \times 50 \text{ km}$ for the case of omnidirectional base station antennas? (1)

(f) If each cell covers five square kilometres then how many subscribers could be supported in an urban market that is $50 \text{ km} \times 50 \text{ km}$ for the case of sectorized antennas? (1)