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3. (b) An analog FDMA cellular system is configured with a cluster size of 7 with the allocated system bandwidth of 12.5 MHz. Two guard spacings of 10 kHz at the edge of the allocated bandwidth is used to protect it from the presence of interference. The number of channels allocated for control signalling for the Base Station (BS) and the Mobile Station (MS) is 21. Assume that each of the cell area is 6 km^2. Determine the following:

(i) the number of available channels per cluster

Answer 3 (b) (i) $B_W = 12.5\ MHz$ $B_S = 10\ kHz \times 2 = 20\ kHz$

The total number of channels per cluster is $\frac{B_W}{B_S} = \frac{12.5 \times 10^6}{20 \times 10^3} = 625$

(ii) the number of channels available for user data transmission

Answer : (ii) The number of signaling control channels is 21

The number of data transmission channels is $625 - 21 = 604$

(iii) the number of channels available for user data transmission per cell if the cluster size or frequency reuse factor is 7

Answer : (iii) The number of data transmission channels per cell is $604/7 \approx 86$

(iv) the overall system spectral efficiency in channels/MHz/km^2.

Answer : (iv) The overall system spectral efficiency is $\eta = \frac{625}{12.5 \times 6 \times 7} \approx 1.19$