

- 1 In a cellular network the audio quality depends on factors. Name what they are.
- 2 Discuss what will happen if a cellular network capacity is lower than the estimated **Busy Hour Call Attempts** (BHCA)., then congestion will occur resulting in many failed calls and customer dissatisfaction.
- 3 If a cell covers an area A_{co} and has a bandwidth of B_{cell} , and each user has bandwidth of B_u , write down an expression for the density of channels.
- 4 A mobile system is effected by a number of noise sources including a man made noise source. Discuss the source of man made noise and how it may effect analogue and digital modulated carrier signal. Comment on the similarity with an impulse signal.
- 5 In communication systems including mobile systems, bandwidth allocation is limited. Discus the significance of this limitation and its impact on the quality of signal be transmitted and received.
- 6 Write down four functions of Base Station Controller (BSC) in mobile communication systems.
- 7 Write down six functions of Mobile Switching Centre (MSC) in mobile communication systems.
- 8 Discuss the advantages and disadvantages of the following in the context of cellular communication systems:
 - Cell Splitting
 - Cell sectorisation
 - Adoptive power
 - Channel assignment strategy
 - Soft hand-off and hard hand-off
 - Smart antennas
- 9 Write down the roles and functions of Mobile Services Switching Center in cellular systems
- 10 Briefly describe the followings:
 - Authentication Center
 - Equipment Identity Register for Mobile Identification Number
 - Operation and Maintenance Center
- 11 What are the Performance Metrics for hand-off?

- 12 Draw a typical block diagram of mobile communication system showing all the modules in particular the noise and interference sources.
- 13 A group of user made 130 calls in one hour with average call duration of 3 minutes. Determine the number of traffic per hour in Erlangs.
- 14 A mobile service provider has been granted 100 MHz of bandwidth to offer services mobile users. It uses 8 7-cell clusters to cover a region. Given that
- Channel allocated per mobile user is 25 kHz
 - Number of call is 3/hour/line
 - the average call duration is 4 minutes
 - 50 % of all call are made international via a T-1 trunk (24 channels) the PSTN.

Determine:

- (i) Bandwidth per cell
- (ii) Total number of channel (mobile users)
- (iii) Carried traffic
- (iv) Channel usage

Professor Z Ghassemlooy

Solution MC5

- 1- Factors are: modulation scheme (e.g FSK, QPSK), matching to the channel characteristics and the processing of the received signal at the receiver using DSPs
- 2- Will result in congestion thus resulting in many failed calls and customer dissatisfaction.
- 3- The density of channels will be $B_{\text{cell}} / A_{\text{co}} * B_u$. It shows that as the coverage area A_{co} is increased, the channel density decreases.
- 4- ..See *lecture notes*
- 5- .. See *lecture notes*
- 6- switching between BTSs, controlling BTSs, network resources management, and mapping of radio channels (Um) onto terrestrial channels (A interface)
- 7- specific functions for paging and call forwarding, termination of SS7 (signaling system no. 7), mobility specific signaling, location registration and forwarding of location information, provision of new services (fax, data calls), support of short message service (SMS) and generation and forwarding of accounting and billing information
- 8- See *lecture notes*
- 9- See *lecture notes*
- 10- See *lecture notes*
- 11- See *lecture notes*
- 12- See *lecture notes*
- 13- Traffic per hour = $130 \times 3 / 60$ in Erlangs
- 14-

Prof. Z. Ghassemlooy