Faculty of Engineering
Zagazig University.
Level Degree: Fourth Year
Date: 5 / 4 / 2025
No. of Questions: 2
Allowed Time: 60 Minutes

2nd term 2024-2025 Midterm Exam
Dept.: Elec & Comm Engineering
Course Name: Communication Systems
Course Code: ECE 424
No. of Pages: 1

Answer the following questions and estimate any missing data

Question No.1:   [20 MARKS]

i. Define the following terms: (8 marks)

    a) Frequency reuse.   b) Transceiver.   c) Handover process   d) Roamer.

ii. What are the channels used in mobile communication systems?   (3 marks)

iii. State the expression that relates co-channel reuse ratio (Q) to radius (R).   (2 marks)

iv. What are the main subsystems of GSM architecture?   (4 marks)

v. What are the frequencies used in the uplink and downlink channel in GSM-1800?   (3 marks)

Question No.2:   [20 MARKS]

i. Give the comparison between fixed channel and dynamic channel assignment.   (4 marks)

ii. Write short note on: Cell sectoring — IMEI — MSISDN.   (6 marks)

iii. Describe the effect of co-channel-interference in mobile communication. How does it affect system capacity?   (4 marks)

iv. If a total of 33 MHz of bandwidth is allocated to particular FDD cellular telephone system which uses two 25 KHz simplex channels to provide full duplex voice and control channels. Compute the number of channels available per cell if a system uses 12 cell reuses.   (6 marks)

If 1MHz of the allocated spectrum is dedicated to control channels. Determine an equitable distribution of control channels and voice channels in each cell.

With my best wishes
Dr. Rania Ahmed

Q1:

i) a) Frequency reuse: use all frequencies in the cluster and use it in the rest of cluster, No frequency reuse in the same cluster.

b) Transceiver: any device can simultaneously transmit and receive Data (info).

c) Handover process: It process transferring automatically MS from Bs to other during call without call drop.

ii) Control channel: • Setting up & maintaining call and other purpose of Control
   • establish relation between MS and Bs.
   traffic channel: transfer data & information in channel.
   uplink channel: radio waves from MS to Bs.
   Downlink channel: radio waves from Bs to MS.

iii) $Q = \dfrac{D}{R} = \sqrt{3N}$, if the radius of cell is increase the ratio will decrease. because the power will reach is will be minimum.

iv) 1 → Mobile station (MS).
   2 → Base Station Sub-system (BSS).
   3 → Network Swithing Sub-System (NSS).
   4 → operating/Maintaining Sub-system (OSS).

V) GSM-1800:

	Uplink	gaurd band	Downlink	
	1710	1785 1805	1880	···· MHZ

uplink = Downlink = 75 MHZ , channel BW = 200 KHZ and gaurd band = 20 MHZ

Q2:

i) Fixed channel: Fixed number of channel does not change.
- when all channels are ocuiped and make a call, the call will Blocking, to solve it use Borrowing channel from other cells.

Adv: • simple in design.
- not complex equipment and algorithm.

Disadv: limit of channel, unused channel remain unused.

Dynamic channel: channels are not permenent.
- when make a call, the BS request from MSC a channel.

Adv: • efficient use of available BW.
- the quality is increased.

Disadv: • complex equipment and algorithm are used.
- high load on MSC.

ii) Cell Sectoring: Instead of using omni-direction antenna use directional anatena and use differance channels in any part to increase the capacity.

IMEI: this is a unique serial number stored in mobile by manu factoring and use to identify the device in the network, It contain 15 digit number.

MSI-SDN: this contain 15 digit contain country's number, network's number and personal number. use to routing calls between subscribers.

iii) when same frequency reuse in cells, in different location, it make interference to reduce this interference increase the Radius of cells or reuse distance when we do that the capacity will reduce because number of cluster will decres ⟶ Because the power will reachis will be minimum.

$R \uparrow \longrightarrow M \downarrow \longrightarrow$ capacity $\downarrow$

$R \uparrow \longrightarrow$ interference $\downarrow$

iv8

No. of Control channel = $\dfrac{1 \, MHz}{2 * 25 \, kHz}$ = 20 control channels

No. of Voice channel = $\dfrac{32 \, MHz}{2 * 25 \, kHz}$ = 640 Voice channels

No. of control channel/cell = $\dfrac{20}{12} = 1 \cdot \dfrac{8}{12}$ $\begin{cases} \text{8 cells have 2 channel} \\ \text{4 cells have 1 channel} \end{cases}$

No. of Voice chanel/cell = $\dfrac{640}{12} = 53 \cdot \dfrac{4}{12}$ $\begin{cases} \text{4 cells have 54 channel} \\ \text{8 cells have 53 channel} \end{cases}$

∴ 8 cells have 2 control channel and 53 Voice channel.

∴ 4 cells have 1 control channel and 54 Voice channel.

∴ each channel has 55 channels.

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