ACCRA INSTITUTE OF TECHNOLOGY
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MID-TRIMESTER EXAMINATIONS
MAY 2022 TRIMESTER
DATE: AUGUST 2022
COURSE CODE: TE 303
COURSE TITLE: WIRELESS & MOBILE COMMUNICATION
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COURSE OUTLINE (MAIN TOPICS)		QUESTION NO.
MajorTopic-1	Introduction to Wireless Communication Systems	Q1B Q3D Q6B
MajorTopic-2	Introduction To Mobile Communication	Q2D Q3C Q5D Q6D
MajorTopic-3	Mobile Architecture (GSM)	Q1C Q1D Q2C Q3A Q4C Q4D Q5B Q5C
MajorTopic-4	The Cellular Concept: Cell Cluster & Frequency Re-Use	Q1A Q2A Q2B
MajorTopic-5	The Cellular Concept: Roaming & Handoffs	Q3B Q4A
MajorTopic-6	Calculations in Mobile Communication	Q4B Q5A Q6A Q6C

PART A

THREE QUESTIONS ANSWER TWO

Question 1

a. Explain why the shape of a cellular cell is **HEXAGONAL**. Explain mathematically the cluster size of a cell that has the following shift parameters: **i=2 and j=1**. Draw the re-use cells of this network.

Major Topic	Blooms	Score
Cellular Concept & Calculations in Mobile	**Designation** *AP*	*8*
Communication		

b. What is Cellular Concept in Mobile Telephony? Explain briefly **THREE** factors of this Concept.

Major Topic	Blooms	Score
Cellular	**Designation** *EV*	*7*
Concept		

c. Write a short note on Public Switched Telephone Network (PSTN) as attributed to telecommunications.

Major Topic	Blooms	Score
Mobile	**Designation** *EV*	*5*
Architecture (GSM)		

d. Explain the importance of **GPRS** to 2G in GSM Cellular Telephony.

Major Topic	Blooms	Score
Introduction To Mobile	**Designation** *EV*	*5*
Communication		

TOTAL SCORE: [25 Marks]

Question 2

    a. The Architecture of GSM Cellular Network is grouped into **FOUR** main areas; list and briefly explain the function of each sector.

Major Topic Mobile Architecture (GSM)	Blooms Designation EV	Score 8

    b. What do you understand by call roaming in mobile telephony? Explain the condition that will occasion this feature and also explain the security feature on the mobile switch that handles this facility.

Major Topic Cellular Concept & Mobile Architecture (GSM)	Blooms Designation AP	Score 6

    c.

    i. What is the basic difference between Bit and Byte in cellular telephony?

    ii. Convert 64 bits per second to byte per second.

    iii.Convert 88 dB to Power in Watts.

Major Topic Introduction To Mobile Communication	Blooms Designation EV	Score 6

    d. Discuss briefly **GPS** in Wireless Communication.

Major Topic Introduction to Wireless Communication Systems	Blooms Designation EV	Score 5

TOTAL SCORE: [25 Marks]

Question 3

   a. With the help of diagrams, explain your understanding of proper and improper handoffs in cellular telephony.

Major Topic Cellular	Blooms Designation	Score
Concept	*AP*	*6*

   b. The closest distance between the centers of two cells using the same frequency (in different clusters) is determined by the choice of the cluster size N and the layout of the cell cluster (frequency reuse distance). Study the table carefully, copy and fill the blank spaces.

	Cell Radius [R]	Cluster Size [N]	Reuse Ratio [Q]	Reuse Distance [D]
i= 2; j= 2	60 m			
i=3; j= 1	70 m			

Major Topic	Blooms Designation	Score
Calculations in Mobile Communication	*AP*	*6*

   c. Explain the function of the Operation and Management Centre (OMC) as associated with mobile telephony.

Major Topic	Blooms Designation	Score
Mobile Architecture (GSM)	*AP*	*5*

   d. With the help of figure 1, explain briefly the difference between **BTS, BCS, SMSC** and **MSC**.
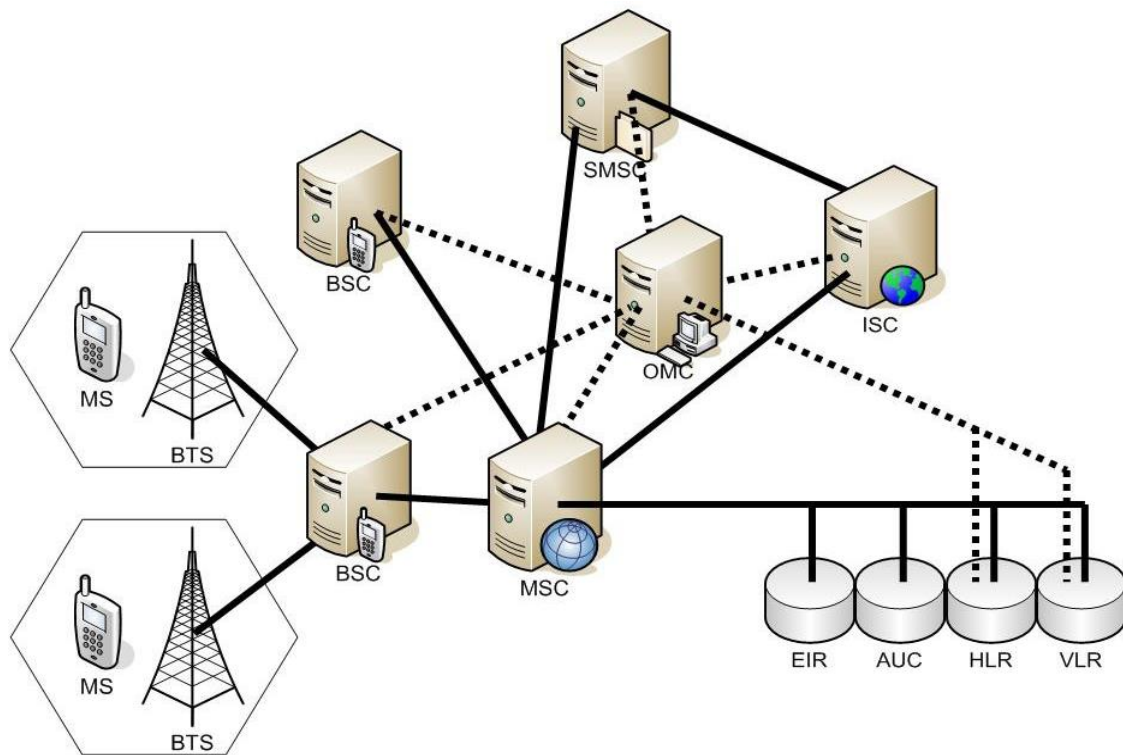
Fig 1

Major Topic Mobile Architecture (GSM)	Blooms Designation *EV*	Score *8*

TOTAL SCORE: [25 Marks]

PART B

TWO QUESTIONS ANSWER ONE

Question 4

a. AltelTigo as a Cellular Communication Service Provider has **1500** total available voice channels to handle traffic in the Volta Region. Assuming the total footprint of AltelTigo's network in the region is

3500 Km^2, prove that the system capacity and the number of channels per cell can be determined knowing that the cluster size is **7** and the coverage area of each cell is **7Km^2**.

Major Topic	Blooms	Score
Calculations in Mobile Communication	**Designation** *AP*	*8*

b. Discuss the difference between the following Mobile Radio Transmission Systems and give **ONE** example each:
- ✓ Simplex (SX),
- ✓ Half-duplex (HDX),
- ✓ Full-duplex (FDX).

Major Topic	Blooms	Score
Intro. to Wireless Communication Systems	**Designation** *AP*	*6*

c. If **60MHz** of the total spectrum is allocated for a duplex wireless cellular system and each simplex channel has **15 kHz** RF bandwidth.

i. Prove that, the number of duplex channels are **2000.**

ii. If the cell reuse can be obtained using **i=3** and **j = 3**; then demonstrate that the total channels per cell site can also be determined.

Major Topic	Blooms	Score
Calculations in Mobile Communication	**Designation** *AP*	*7*

d. Explain the functional difference between Frequency Division Duplex (FDD) and Time Division Duplex (TDD).

Major Topic	Blooms	Score
Introduction To Mobile Communication	**Designation** *AP*	*7*

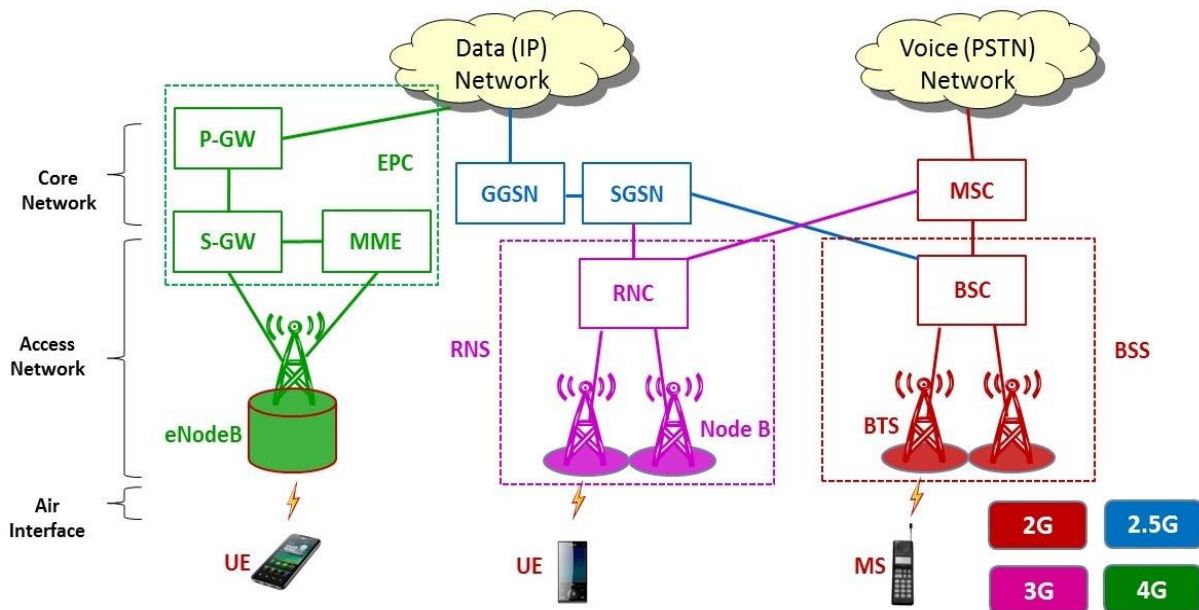**TOTAL SCORE: [25 Marks]**

Question 5

a. Vodafone decides to use a digital TDMA scheme that can tolerate a Signal-to-Interference Ratio of 17dB in the worst case. Show that the optimal value of the path lost exponent, γ for an omnidirectional antenna can be determined; assuming **i=3** and **j=2.** Assume that there are six co-channel cells in the first tier, and all of them are at the same distance from the mobile. Use suitable approximations.

Major Topic	Blooms	Score
Calculations in Mobile Communication	**Designation** *AP*	*8*

TOTAL SCORE: [25 Marks]

b. You are presented with the cellular topology as shown in figure 2; explain briefly the interconnections between the various mobile generations.
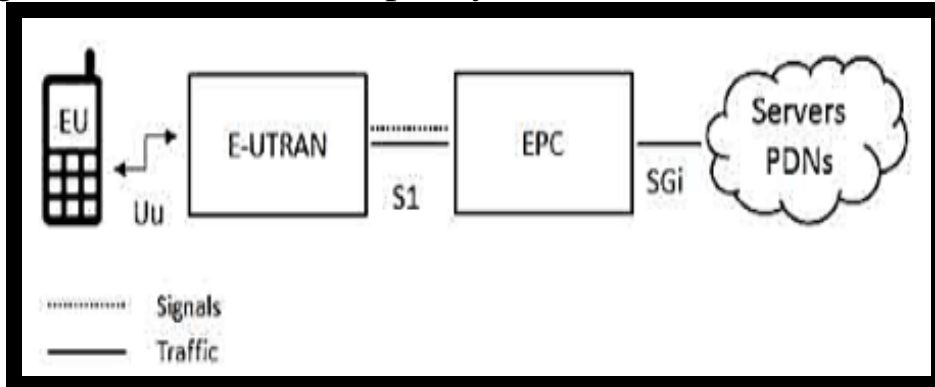

Fig 2

Major Topic	Blooms	Score
Mobile	**Designation** *EV*	*6*

Architecture (GSM)		

c. There are **THREE** main components that constitute 4G (LTE) Architecture Network as shown in figure 3; briefly explain the function of each component as exclusively pertains to fourth generation cellular telephony.

Fig 3

Major Topic Mobile	Blooms	Score
	Designation	6
Architecture (GSM)	EV	

d. Explain briefly the social challenges in mobile telephony that call for evolution of 5th generation cellular telephony.

Major Topic Introduction To Mobile	Blooms	Score
	Designation	5
Communication	EV	

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