Name: **Enrolment No:**	

UPES

End Semester Examination, December 2023

Course: Cellular and Mobile Communication **Semester: VII**

Program: B. Tech Electronics and Communication Engineering **Time : 03 hrs.**

Course Code: ECEG 4032 **Max. Marks: 100**

Instructions: Answer all the questions.
The diagram must be neat and clean.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Differentiate between GSM, UMTS, LTE, and LTE-A under its technical specifications.	**4**	**CO1**
Q 2	Discuss the salient features of the multiple access technique employed in 4G.	**4**	**CO1**
Q 3	Discuss the specifications requirements of the cellular base antenna.	**4**	**CO1**
Q 4	Mention the name of the multiple access technique employed in the following mobile cellular system. LTE-A (downlink), GSM, TACS, LTE (uplink)	**4**	**CO1**
Q 5	Mobile Set, Base Station (Base Transceiver System), Mobile Station Centre, and Home Location Register are constituents of GSM architecture. Reveal the name of their counterpart in UMTS architecture.	**4**	**CO2**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	A member of the Mittal family residing in Haldwani possesses an iPhone 15, with an Airtel SIM card inserted. Unfortunately, none of the operators in the vicinity offer a 4G system, so all subscribers have to make do with 2G service. Meanwhile, a friend from the Tyagi family in Saharanpur owns an iPhone 14 Pro, but the network operator in that area lacks a UMTS/LTE system. Instead, both operators in these locations employ a dedicated and high-quality GSM architecture. Briefly discuss the process of how a voice call is established between the called party and the caller party.	**10**	**CO3**
Q 7	LTE technology is meant to provide 4G service. Illustrate a visual block diagram showing its system and subsystem, along with the interfaces that	**5+5**	**CO2**

	connect them. Additionally, draw a diagram illustrating various types of handovers within a cell structure.		
Q 8	A cellular operator company was assigned to lay the cellular tower in a town. The engineers from the operator divided the town into 20 clusters and installed the tower with N = 7 structure. The town is uniformly populated semi-urban type with a normal mobile environment. Compute the value of C/I for the given cell structure with an omnidirectional antenna pattern. With the growing number of cellular customers in the area, the call quality has started to degrade. How the value of C/I will be increased, so that this ratio will be higher than 20 dB, without any addition of base tower installation? Determine the value of the new C/I.		**CO3**
Q 9	Outline the driving factors that influence the development of LTE. Describe the technical specifications of LTE, with a particular focus on the bands, modulation, multiplexing, and multiple access methods utilized.		**CO2**
SECTION-C (2Qx20M=40 Marks)			
Q 10	On the occasion of his wedding in a village on the outskirts of Gorakhpur, Tripathy desires to have all of his friends in attendance. His friends, who are employed at reputable companies, are willing to join him on the condition that the village possesses a robust cellular network with at least basic LTE service. To make this happen, Tripathi entrusted the task of establishing a dependable cellular network for the entire village to Sisodia and Saini. The designated coverage area spans 20 square kilometers, and it has been strategically designed to accommodate a 7-cell structure system for efficient utilization of the cellular spectrum. To meet the requirements, the following specification has been finalized: • A 2-kilometer distance is maintained between two towers within each cluster. • The spectrum allocated for cellular mobile service ranges from 1700 MHz to 1770 MHz for uplink, using Frequency Division Duplexing (FDD). • Both the downlink carrier and resource block have a channel bandwidth of 10 MHz. • The transmitter power is set at 10 watts. • The environment's propagation path constant is 3. • The threshold distance for handoff at the edge is 20 meters. • The switching time is established at 100 milliseconds. Now, calculate. (a) The number of channels per cell in the area. (b) The capacity of the system.	**20**	**CO4**

	(c) The number of subscribers accessing the 4G service of fast downlink if 100 subscribers share one resource block. (d) The threshold value for handoff. (e) The threshold speed of mobile users.		
Q 11	A structure of spectrum allocation for AMPS cellular technology (900 MHz band) is shown below, where 1, 2,3….N are the number of channels, and G is the guard band between adjacent channels. 1 G 2 G .. .. N The allocated spectrum bandwidth (duplex mode) is 50 MHz, whereas each channel requires a bandwidth of 20 kHz to support voce communication, and the guard band is 2 kHz. the allocated frequency to channel 1 is 850 MHz to 850.02 MHz. The same spectrum band is updated on 2G system, whereas each channel is shared by 10 mobile subscribers. The frame is repeated at every 100 ms time. The frame structure of GSM is shown below, where G is the guard bits space. Trail bit | Data | G | Data | Trail bit | G 20 | 70 | 5 | 70 | 20 | 5 Then, Determine (a) The total number of subscribers in the AMPS system. (b) Efficiency of the AMPS system. (c) Number of subscribers per cell with N=4 structure. (d) Total number of subscribers in the GSM system. (e) Efficiency of the GSM system. (f) The transmission rate in the GSM system. (g) Uplink and Downlink frequency allocation in either of the two systems. (h) Total number of subscribers (if the AMPS system with FDMA technique is upgraded to LTE system with OFDMA with the sub-carrier separation is equal to the guard band). (i) Name of device in user hand in AMPS, GSM and LTE. (j) Name of the subsystem responsible for roaming in AMPS and GSM.	**20**	**CO3**