Name: **Enrolment No:**	

UPES

End Semester Examination, December 2024

Course: Wireless Communication **Semester: V**

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

Course Code: ECEG 3062 **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 LTE and NR under its technical specifications.	**4**	**CO1**
Q 2	Discuss the salient features of the multiple access technique employed in AMPS.	**4**	**CO1**
Q 3	Discuss the specifications requirements of the cellular base antenna.	**4**	**CO1**
Q 4	Determine the distance from the nearest co-channel cell for a cell having a radius of 0.64 km and a co-channel reuse factor of 12.	**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	With what velocity space station is orbiting around the earth, from a height of 600 km above the surface of the earth to move in a circular path? Also determine its period of revolution. Given: G = 6.67 x 10^{-11} Nm^2/kg^2, radius of earth = 6.4 x 10^6m, Mass of the earth = 5.98 x 10^{24} Kg.	**10**	**CO3**
Q 7	Differentiate between OFDM and OFDMA and elaborate on the key features of OFDMA. List out the advantages and disadvantages of it	**5+5**	**CO2**
Q 8	A student who has NOKIA 3110 set residing in Bidholi campus made a call to her Masi, having Apple phone and residing in the Selaqui area of the Dehradun. The operator serving for both the calling party and the called part is BSNL, and the serving technology is prior to UMTS era. Briefly discuss the process of how a voice call is established between the called party and the caller party.	**10**	**CO3**

<table>
<tr><td>Q 9</td><td>LTE technology is meant to provide 4G service. Illustrate a visual block diagram showing its system and subsystem, along with the interfaces that connect them. Additionally, draw a diagram illustrating various types of handovers within a cell structure.</td><td>10</td><td>CO2</td></tr>
<tr><td colspan="4">SECTION-C
(2Qx20M=40 Marks)</td></tr>
<tr><td>Q 10</td><td>(a) Consider that a geographical service area of a cellular system is 500 km^2. A total of 200 radio channels are available for handling traffic. Suppose the area of a cell is 2 km^2. (a) How many times would the cluster of size 7 have to be replicated in order to cover the entire service area? Calculate the number of channels per cell and the system capacity. (b) If the cluster size is decreased from 7 to 4, then does it result in an increase in system capacity? Comment on the results obtained.

(b) In a cellular system featuring a 3-sector directional antenna configuration, consider a scenario where a mobile receiver is positioned at the edge of its designated cell. This receiver is affected by interfering signals originating from cochannel interfering cells in the primary tier. Calculate the most adverse signal-to-cochannel interference ratio (C/I) at this mobile receiver. It is noted that, in practice, the C/I value necessitates an additional 6 dB compared to the theoretical C/I value of 18 dB. Assume a path-loss exponent of 4 within the context of a mobile radio environment. Then comment on the results obtained for cluster sizes (a) 7 (b) 4.</td><td>10+10</td><td>CO4</td></tr>
<tr><td>Q 11</td><td>(a) 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.

<table><tr><td>1</td><td>G</td><td>2</td><td>G</td><td>..</td><td>..</td><td>..</td><td>..</td><td>..</td><td>..</td><td>N</td></tr></table>
The allocated spectrum bandwidth (duplex mode) is 50 MHz, whereas each channel requires a bandwidth of 20 kHz to support voice communication, and the guard band is 1 kHz. the allocated frequency to channel 1 is 950 MHz to 950.02 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</td><td>10+10</td><td>CO3</td></tr>
</table>

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

(i) The total number of subscribers in the AMPS and GSM system.

(ii) Efficiency of the AMPS and GSM system.

(iii) Uplink and Downlink frequency allocation in either of the two systems.

(iv) Name of device in user's hand in AMPS and GSM system.

(v) Modulation and multiple access used in both system.

(b) 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.