

**Total number of printed pages: Programme(UG)/Semester VII/UECE712A
2024**

Wireless and Mobile Communication

Full Marks: 100

Time: Three hours

The figures in the margin indicate full marks for the questions.

Answer any five questions.

1.	a)	Find out an expression for S/I (signal-to-interference ratio) of a cellular system with hexagonal layout, when the mobile is located at the boundary of the cell (worst case). Assume that all cells have equal radii and that the base stations have equal power and are located in the centers of each cell. Calculate S/I for the above case with cluster size, $N=7$ and path loss exponent equal to 4.	8+3=11
	b)	State the channel characteristics of CDPD, ARDIS and RMD.	3*3=9
2.	a)	Discuss the free space propagation model, explaining Friis space equation, path loss (P_L), Fraunhofer distance and the received power at a distance d ($P_r(d)$). Make assumptions, if required.	10
	b)	Describe the GSM system architecture and the various interfaces used in GSM. What are the various GSM control channels.	10
3.	a)	Determine the S/I at the mobile when the mobile is located at the cell boundary for cluster size, $N=3$, with three sectors (BW-120°, $i_o=3$) and six sectors (BW- 60°, $i_o=2$) per cell. Take path loss exponent equal to 4. Comment on the improvement of S/I in the two cases.	7
	b)	The coverage area of a cellular system is 2000 sq. km with cell having a radius of 5 sq. km, and there are a total of 1000 radio channels available for handling the traffic. Calculate the system capacity for 7-cell reuse. If $N=4$, how many times the cluster has to be replicated to approximately cover the entire area. Calculate the system capacity for the given case.	6
	c)	Draw a neat block diagram for discrete OFDM system. Discuss the IFFT stage before the upconversion stage.	3+4=7
4.	a)	Explain Nyquist criterion for zero ISI. What are the problems with Nyquist's ideal filter?	4+2=6
	b)	What is a raised cosine filter. Show schematically transfer functions of Nyquist's filter and raised cosine filter for different roll-off factors.	6
	c)	What is code division multiple access (CDMA)? Explain CDMA encoding, decoding, multiplexing and demultiplexing with the help of an example and appropriate diagram.	2+6=8
5.	a)	Find out the expressions for efficiency and no. of channels for TDMA system.	6

	b)	A GSM system has 6 bits as trailing bits, 26 training bits, 8.25 guard bits and 2 bursts of 58 bits of encrypted data which is transmitted at 270.833 kbps in the channel. Find i) frame rate and ii) frame efficiency.	5
	c)	What do you mean by inter symbol interference (ISI)? What are its causes? Explain how ISI and multi path effect are mitigated in OFDM using guard interval and cyclic prefix?	2+2+5=9
6.	a)	What do you mean by small-scale fading? What are its effects? What are the factors that influence small-scale fading? What is Doppler effect? Find an expression for Doppler shift.	10
	b)	In the digital cellular system, carrier frequency is 900 MHz and the mobile velocity is 70km/hr. Calculate the received carrier frequency if the mobile is moving i) directly toward the transmitter, ii) directly away from the transmitter and iii) in a direction perpendicular to the direction of the arrival of the transmitted signal.	6
	c)	Find the Fraunhofer distance for an antenna with maximum dimension of 1 metre and operating frequency of 900 MHz. If antennas have unity gain, calculate the path loss.	4
7.		Write short notes on- i) salient features of IS-95, ii) protocol stack of CDMA 2000, iii) TDMA/FDD, iv) soft handoff and hard handoff.	5*4=20

ESTD. : 2006
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