


Name:			
Enrolment No:			
UPES End Semester Examination, May 2024			
Course: 5G Systems and Technologies Program: B. Tech ECE Course Code: ECEG4061P		Semester: VIII Time: 03 hrs. Max. Marks: 100	
Instructions: Answer must be brief and to the point. Diagram must be neat and clean.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q. 1	Describe the handoff strategies used in wireless communication.	4	CO1
Q. 2	Describe the delay spread in wireless communication and its significance in terms of inter symbol interference.	4	CO2
Q. 3	Describe the data establishment in 4G LTE standard with neat diagram.	4	CO1
Q. 4	Describe the channel coefficient matrix for SISO, MISO and SIMO system along with transmit and receive vector.	4	CO1
Q. 5	Discuss frequency reuse in cellular system. How cluster size affects the capacity and co-channel interference in cellular system?	4	CO1
SECTION B (4Qx10M= 40 Marks)			
Q. 6	(a) Discuss the next generation core architecture of 5G with neat diagram. Difference between Node B, eNodeB and gNodeB(gNB) in different cellular system. <p style="text-align: center;">or</p> (a) If a TDMA uses a frame structure where each frame consists of 8 time slots, and each time slot contains 156.25 bits, and data is transmitted at 270.833 kbps in the channel, find (i) the time duration of a bit, (ii) the time duration of a slot, (iii) the time duration of a frame, and (iv) how long must a user occupying a single time slot must wait between two simultaneous transmissions.	5+5	CO4
Q. 7	Describe the significance of IFFT/FFT and cyclic prefix in OFDM. Draw its transmitter and receiver diagram and explain function of each block.	10	CO2
Q. 8	(a) Discuss the features of UMTS network. Draw the neat architecture of it. (b) Discuss the call flow process in UMTS with appropriate process diagram.	10	CO2

Q. 9	Discuss the block diagram of MIMO. Describe the model for MIMO system and describe its channel coefficient matrix.	10	CO1
SECTION-C (2Qx20M=40 Marks)			
Q. 10	<p>(a) Consider that a geographical service area of a cellular system is 500 km². A total of 200 radio channels are available for handling traffic. Suppose the area of a cell is 2 km². (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 into increase in system capacity? Comment on the results obtained.</p> <p>(b) Define co-channel interference and derive the expression for signal to interference ratio. Also, discuss the C/I for worst-case analysis in an omnidirectional antenna system (K or N=7).</p>	10+10	CO3
Q. 11	<p>In Gorakhpur, a cellular operator named Tripathi Telecom assigned one engineer group, led by Kriti, to deploy cellular towers, while another engineer group, headed by Titiksha, was tasked with managing carrier levels and sectoring.</p> <p>The telecom operator planned to extend services to a new town, Devaria, near Gorakhpur. Team Kriti divided the town into 10 clusters and installed towers with an N=7 structure. The path loss propagation constant for the environment is 4. However, after a few months, it was observed that call quality deteriorated due to the increasing number of cellular customers. Upon inspection by team Titiksha, it was discovered that the carrier-to-interference (C/I) ratio deviated significantly from the calculated value. The operator revealed that instead of the planned hexagonal cell design, square-shaped cells were installed.</p> <p>The telecom operator tasked team Titiksha with sectoring the existing cells without installing additional base towers.</p> <p>(a) Calculate the theoretical (hexagonal) and real (square) values of C/I. (b) Determine the improvement in C/I upon sectoring by ITNB2. (c) Provide a sketch of the sectored design.</p>	20	CO4