Duration: 3hrs **[Max Marks: 80]**

N.B.: (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required, and state it clearly.

1		Attempt any FOUR	**[20]**
	a	Explain the concept of frequency reuse with suitable example.	**[5]**
	b	Differentiate between CDMA 2000 and WCDMA	**[5]**
	c	State radio specifications of GPRS & EDGE	**[5]**
	d	Why millimeter wave communication is not preferred for long distance communication? State its merits.	**[5]**
	e	What is software defined radio? State two applications.	**[5]**
2	**a**	A mobile is located 5km away from a base station and uses a vertical λ/4 monopole antenna with a gain of 2.55dB to receive cellular radio signals. The E-field at 1km from the transmitter is measured to be 10^{-3} V/m. The carrier frequency used for this system is 900MHz. i) Find the length and the gain of the receiving antenna. ii) Find the received power at the mobile using the 2-ray ground reflection model assuming the height of the transmitting antenna is 50m and the receiving antenna is 1.5m above the ground.	**[10]**
	b	State and explain UMTS channels. Give air interface specifications.	**[10]**
3	**a**	What is MIMO? How Massive MIMO systems are influencing future	**[10]**
	b	Derive the relation for Doppler shift to the mobile velocity and the spatial angle between the direction of motion of the mobile and the direction of arrival of the wave. What are the fading effects due to Doppler spread?	**[10]**
4	**a**	A hexagonal cell within a 4-cell system has a radius of 1.387km. A total of 60 channels are used within the entire system. If the load per user is 0.029 Erlangs, and λ=1 call/hour, compute the following for an Erlang C system that has a 5% probability of a delayed call : i) How many users per square kilometer will this system support? ii) What is the probability that a delayed call will have to wait for more than 10 s? iii) What is the probability that a call will be delayed for more than 10 seconds?	**[10]**
	b	Illustrate 3GPP core network architecture and explain functions of each block in detail.	**[10]**
5	**a**	Draw and explain GSM network architecture	**[10]**
	b	What is CDMA? State its types. How it works?	**[10]**
6	**a**	Explain frames, slots and symbols used in physical layer of 3GPP LTE.	**[10]**
	b	Write a note on (any TWO) i) Cognitive Radio ii) PAPR in OFDM iii) NOMA	**[10]**

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