VIT

Vellore Institute of Technology

CHENNAI

Continuous Assessment Test II– March 2024

Programme	:	B.Tech. (ECE)	Semester	:	Winter Sem 2023-24
Course Code & Course Title	:	BECE307L Wireless and Mobile Communications	Class Nbr	:	CH2023240500952 CH2023240500930 CH2023240500944 CH2023240500948 CH2023240500933 CH2023240500940
Faculty		Dr. Priyanka Das Dr. D. Thiripurasundari Prof. Ralph Samuel Thangaraj Dr. S. Usha Rani Dr. Vetrivelan P Dr. Vydeki D	Slot	:	A2
Duration	:	90 Minutes	Max. Marks	:	50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Only non-programmable calculator without storage is permitted

Answer all questions

Q.No.	Sub. Sec.	Questions	Marks
1.		The Okumura model is one of the most widely used models for signal prediction in sub-urban areas. Following is the data given: the distance between the transmitter and the receiver is 5 km, base station antenna height is 30 m and mobile antenna height is 2 m. The median attenuation relative to free space is 22 dB and the gain due to the type of environment encountered by the radio signal is 11.5 dB. • Using this model, calculate the median value of the propagation path loss of a radio signal at carrier frequency of 2 GHz. Answer the following question without carrying out any calculation. Will the median path loss computed using the Hata model closely resemble your answer?	[10]

2. a. Sketch the power delay profile of a wideband channel given in Table 1. [10]

Table 1 Power-delay Profile

Delay (ms)	Power level (dB)
0	1
0.8	3
1.8	6
3	8

Determine the following:
(i) the rms delay spread & coherence bandwidth for correlation function is above 0.5. [5]
(ii) For a vehicle traveling 75 m/s using an 1800 MHz carrier, find the time at which the channel appears stationary. [2]

b. Design a radio system for public safety which operates at 800 MHz, and it can handle a certain amount of Doppler spread. What maximum Doppler spread can be handled if a fast-moving emergency vehicle would be able to communicate while driving at 140 miles per hour? [3]

3. a. Consider a suitable fading distribution which follows an NLOS signal experiencing a maximum Doppler frequency of 40 Hz. The carrier frequency is 1900 MHz. [10]
Compute the following:
(i) If a bit error occurs whenever the bit encounters a fade for which $\rho = 0.1$, what is the average number of bit errors per second for a binary digital modulation with a data rate of 100 bps? [4]
(ii) the maximum velocity of the mobile for the given Doppler frequency. [1]

b. Consider a mobile subscriber traveling at a uniform velocity of 100 kmph receives digital data from a wireless communication system operating at 900 MHz carrier frequency. What should be the minimum symbol rate for receiving distortionless transmission? [5]

4. [5]

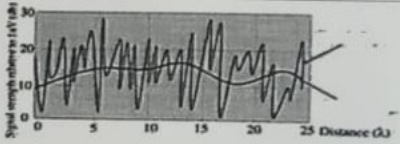

Fig.1

(i) Identify the type of fading indicated by the (a) solid line (b) fluctuating line in Fig.1, with suitable explanation. [3 Marks]

(ii) If rms delay spread of a specific multipath channel is $2\mu s$, for a system with symbol rate 1000KHz, is this a flat fading or frequency selective fading channel? [2 Marks]

5.	a.	For the scenario given, choose and justify your choice between a multicarrier modulation scheme and a single carrier modulation scheme. • A new seaport boasts high automation, including driverless trailers for container transport. • Containers are unloaded from ships onto these trailers, which stack them in the port's storage area. • Stacks can reach heights of up to 8 containers and fluctuate as containers are moved. • Due to safety concerns and initial costs, human operators control the trailers remotely from a central center. • Trailers transmit low-resolution, high frame-rate video and sensor data multiplexed into a single stream. • Operators send low data rate control signals to the trailers. • Safety is paramount for both human operators and cargo security.	[7]
	b.	An OFDM signal has a bandwidth of 6 MHz and 512 subcarriers. If the cyclic prefix is said to be 18% of the raw OFDM symbol time, and is 1.4 times the maximum delay spread, how many samples of the CP are affected by ISI. What could be the data rates for the signal with CP, if (i) 64-QAM is used and (ii) QPSK is used.	[8]

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