VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)
CHENNAI

Reg. Number:	21BEC1851

Continuous Assessment Test II – March 2024

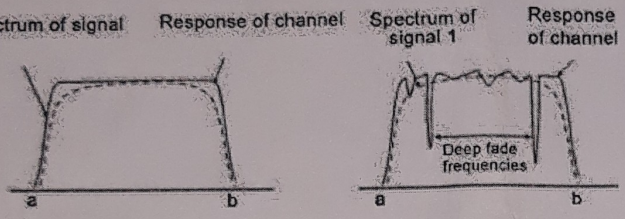
Programme	:	**B. Tech. (ECE)**	Semester	:	**WS 2023-24**
Course Code & Course Title	:	**BECE307L Wireless and Mobile Communications**	Slot	:	**A1**
Faculty		**Dr. Hemanth C Dr. Priyanka Das Prof. Ralph S Thangaraj Dr. D. Thiripurasundari Dr. S. Usha Rani**	Class Nbr	:	**CH2023240500936 CH2023240500948 CH2023240500956 CH2023240500926 CH2023240500942**
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.		Find the median path loss under the Hata model, for a radio signal at 900 MHz cellular system operating in a large urban city, with a base station transmitter antenna height of 20 m and mobile receiver antenna height of 2 m. The mobile unit is located at a distance of 3000 m. Also compute the median path loss when the system is operated in a rural scenario. Explain qualitatively the path loss difference in these environments.	[10]
2.		For the given specifications with 4 delay components as described below: • Power at 0^{th} ms = Add the last two digits of your home location pin code in dB. • Power at 1 ms = Use your current age in dB. • Power at 2 ms = Subtract the age value obtained (corresponding to 1 ms) from the last two digits of the current year (2024) in dB. • Power at 4 ms = Subtract the age value obtained (corresponding to 1 ms) from the first two digits of your year of birth in dB. (i) Construct a Power delay profile for a wireless channel with the above specifications. [2]	[10]

		(ii) Determine rms delay spread and mean excess delay for the channel. [4] (iii) Determine maximum excess delay (power level in dB corresponding to 2 ms. [1] (iv) If a mobile user moves at a speed of 60 km/hr, while the BS transmits at 1800 MHz, identify whether the received signal undergoes fast fading or slow fading. Assume the baseband binary message has a bit rate of 100 kbps. [3]	
3.	a.	A mobile subscriber travels at a uniform speed of 100 kmph. Compute the time between the fades and average fade duration for $\rho=1$, when the mobile uses (i) a cell phone operating at 800 MHz	[10]
	b.	(ii) (ii) a PCS phone operating at 1850 MHz. [5] Consider a vehicle moving at 60 miles per hour at an arrival angle of $\theta = 30^\circ$ with the base station. Compute the Doppler shift of the received signal at a carrier frequency of 1900 MHz. [5]	
4.		 Fig.1a Fig. 1b (i) Identify the types of channels depicted in Fig.1a and Fig.1b with suitable explanation. [3 Marks]	[5]
		(ii) A cell phone user is in a vehicle that moves at a speed of 120km/hr. The carrier frequency is 1800MHz. The symbol period of a system is 3ms. Is the system experiencing fast fading or slow fading? [2 marks]	
5.	a.	In a multi-building office complex with many tall buildings, a company with offices in two separate buildings requires a wireless link between them. The link should be able to support high data rates and can accept errors within limit. The company's tech team opts for OFDM as the physical layer for the link. However, they encounter excessive non-data bit overhead in standard OFDM, prompting the need for customization. What modifications can be implemented to ensure the optimal features of OFDM are retained while meeting the users' needs?	[7]
	b.	A raw OFDM symbol (No CP) has a duration of 40μs. The OFDM signal has a bandwidth of 5 MHz. Assuming no cyclic prefix, and modulation being 16-QAM, what is the data rate? By how much will the data rate reduce if 10% of the subcarriers are kept for pilot transmissions and not for data. If we change the modulation scheme from 16-QAM to a higher m-ary scheme to make up for the loss, what should be the new modulation scheme.	[8]

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