Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER BTECH. (E & C) DEGREE END SEMESTER EXAMINATION

JULY 2022

SUBJECT: WIRELESS COMMUNICATION (ECE -3252)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A.	From the fundamentals, derive an expression for critical distance in two ray model. Determine the critical distance for an indoor microcell having h_t= 3m and h_r= 2m. Operating frequency is 2GHz
1B.	Consider an indoor wireless LAN with *f*c = 900 MHz, cells of radius 10 m, and omnidirectional antennas. For free space path loss model, what should be the transmitted power if all receivers within the cell are to receive a minimum power of 10 µW?. How does this change if the system frequency is 5GHz?
1C.	Obtain an expression for Doppler shift with geometry associated with it
	(5+3+2)
2A.	From the fundamentals obtain the expression for cell coverage area assuming a circular cell.
2B.	A fading channel shows an impulse response with peaks at relative power and time having the following values: -15 dB at 1µS, 0 dB at 10 µS, -25 dB at 18 µS, -10 dB at 25 µS. Determine a) Average delay spread b) RMS delay spread
2C.	With neat diagrams, explain power delay profile and coherence bandwidth
	(5+3+2)
3A.	Derive an expression for optimal power allocation and Shannon capacity of a wireless channel when CSI is available at both transmitter and receiver.
3B.	Consider a time invariant frequency selective block fading channel that has four subchannels of bandwidth B=10MHz. The frequency responses associated with each subchannel are H_1=1, H_2=0.5, H_3=2 and H_4=0.25 respectively. The transmit power constraint is P= 10mW and noise PSD $N_0/2$ has N_0=0.001µW/Hz. Find the Shannon capacity of this channel
3C.	How Doppler spread and ISI affects symbol error probability in fading channels?
	(5+3+2)
4A.	For a flat fading channel the received SNR is a random variable taking on values 30dB, 20dB, 10dB and 0dB with probabilities 0.2, 0.3, 0.3 and 0.2 respectively. Assume that both transmitter and receiver have CSI. (i) Obtain the optimal power adaptation policy for this channel and its corresponding Shannon capacity per unit bandwidth (ii) Determine the

	channel inversion power adaptation policy and associated zero outage capacity per unit bandwidth of this channel.
4B.	Derive an expression for the average probability of error, for BFSK in a Rayleigh fading channel
4C.	Binary data are transmitted over microwave link with average SNR=6.9696 dB. Compute the probability of error for DPSK in AWGN and Rayleigh fading channel
	(5+3+2)
5A.	Explain the various diversity combining techniques used in receiver diversity systems and show how selection combining improves outage performance for channel with 4 branches.
5B	With relevant diagrams, explain the Alamouti scheme of transmitter diversity in the absence of CSI at transmitter
5C.	With a neat block diagram, explain decision feedback equalizer.
	(5+3+2)