Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

SEVENTH SEMESTER B.TECH. (E & C) DEGREE END SEMESTER EXAMINATION
MARCH 2021
SUBJECT: WIRELESS COMMUNICATION (ECE - 4101)

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

Instructions to candidates

- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed.

1A. For a Rayleigh fading wireless channel, derive an expression for outage probability and average probability of error for BFSK modulation.

1B. Write descriptive note on Diversity. With relevant diagrams, explain the Alamouti scheme of transmitter diversity in the absence of CSI at transmitter.

1C. Find the required average bit energy to noise density ratio for BPSK modulation in slow Rayleigh fading such that, in 95% of the locations probability of bit error is less than or equal to 10^{-4}. **NOTE:** for BPSK, the target BER is achieved at SNR of 8.5dB.

(5+3+2)

2A. In terrestrial microwave link, LOS limits the separation of transmitter and receiver about 40km. If 100mW transmitter is used at 4GHz, find receiver power in dBm if (a) isotropic antennas are used (b) non-isotropic antennas with gains 30.5dB are used. Also find the induced voltage at the receiving antenna terminals, if matching impedance is 50ohms.

2B. If minimum SNR required for an acceptable performance is 7dB and average SNR is 15dB, find the outage probability of BPSK modulation for 2-branch SSC i.i.d. Rayleigh fading channel with threshold SNR values of 5dB and 10dB.

(5+5)

3A. A WSSUS channel has a multipath delay spread of 1 s and Doppler spread of 0.02 Hz. The total channel bandwidth of transmitted signal is 10 Hz and symbol duration chosen is 10 s. (i) Find coherence bandwidth and time (ii) Does channel exhibit frequency selective fading? (iii) Does channel exhibit slow and fast fading? (iv) Find transmission data rate.

3B. Show that for a narrowband fading channel the autocorrelation of in-phase and quadrature components of received signal is same and WSS.

(5+5)

4A. Explain Power Delay Profile. The multipath intensity profile for a particular channel is given by $A_c(\tau) = \exp(-\tau/0.00001)$ for $0 < \tau < 10$ μs and zero elsewhere. Find the mean and rms delay spreads of the channel and find the maximum symbol rate such that a linearly modulated signal transmitted through this channel does not experience ISI.

4B. With usual notations, derive an expression for cell coverage area. Obtain its simplified form also.

(5+5)

5A. Derive an expression for path gain for 2-ray model. What are the advantages and disadvantages of 2-ray model? If h_t, h_r, and d values are 35m, 3m, and 250m respectively, then whether 2-ray model is applicable and why? Repeat your answer for 30, 1.5m and 450m.

5B. Derive an expression for optimal power allocation and Shannon capacity of a block fading channel. Explain with all necessary diagrams.

(5+5)