**Assigned Task\_dated 25 March 2020:**

**Submission Date: April 15, 2020**

1. Define mutual information, channel capacity and joint entropy.
2. Deduce the entropy of a continuous random variable “*X*”, which is Gaussian distributed with zero mean and of variance N.
3. Write down the conditions for a wireless channel to be both frequency flat and time flat.
4. What is the maximum Doppler spread for the mobile moving with velocity v?
5. Draw the baseband equivalent model of a Rayleigh channel with Doppler.
6. Write down the channel capacity expressions for a receive diversity (SIMO) in a fading channel mentioning the parameters used?
7. A received complex signal is given by z = x (t) + j y (t). Both x(t) and y(t) are zero-mean Gaussians with unit variance. Find both the mean square value and the variance of .
8. Draw the R.F. equivalent of a Rician channel model with Doppler.
9. Find the mean delay of the power delay profile:
10. Draw versus sub-carrier n and indicate the optimum power allocation policy. Write down the essential constraints in optimum bit loading for an OFDM system.
11. The multi-path power delay profile is given by, . Find the mean delay .
12. What will be the capacity of a 1x4 SIMO system, given 2 dB and h1 = h2 = h3 = h4 = 3.
13. Find the capacity of a Rayleigh faded SISO channel given: and SNR = 4.
14. Write down the channel matrix for a 3x2 MIMO system. What will be the SNR at each SNR at each antenna input of the receiver if each transmit antenna signal power is 0.2 watt.
15. Express the channel capacity of a MISO system. Define the parameters involved in the expression.
16. Consider a flat fading channel with a bandwidth of 30 KHz and two possible received SNRs; with = 30 with p( = 0.1, and = 10 dB with p( = 0.4. Find the ergodic capacity of the channel.
17. Binary data is transmitted at the rate R bits/sec over a channel occupying bandwidth B and channel SNR = 3 dB, if the data rate is increased to 2.65 R and the bandwidth is increased to 1.75 B, what would be the channel SNR of the new system?
18. A complex envelop, , *x(t)* and *y(t)* are zero-mean Gaussian each with unity variance. Find the mean and the rms values of the distribution of the envelop of z.
19. For a wireless channel, and . Find the maximum data rate the channel can transmit without any significant ISI.
20. For a frequency-selective block fading channel with 3 sub carriers each of bandwidth = 1 MHz and having respective SNRs , Find the channel capacity under optimal power allocation.
21. Find the secondary capacity given that,
22. Find the channel capacity of a fading channel with the following channel description:

|  |  |  |  |
| --- | --- | --- | --- |
| h(i) | 0.2 | 0.3 | 0.1 |
| p(i) | 0.2 | 0.3 | 0.5 |

Given PT = 10mW, No = 10-9W/Hz and B = 50 kHz.

1. Consider a complex flat Rayleigh fading MIMO channel,with transmit/receive antennas Nr = Nr = 2, and the receiver has AWGN with zero-mean, and unit variance. The h(n)s are:

|  |  |
| --- | --- |
| S. No. | Gain |
| 1 | * 1. 0.7662 |
| 2 | * 1. 0.2760 |
| 3 | – 0.8365 + j0.2766 |
| 4 | 0.7134 + j0.3141 |

Assume , and calculate the capacity of the above system..